Inner Belt Loop Connection Planning Study

Prepared for:

Billings City-County Planning Department
Billings, MT

In Cooperation with:

City of Billings

Yellowstone County

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Executive Summary

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Executive Summary to be inserted in Final Report

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Inner Belt Loop Connection Engineering Planning Study

I. Study Authorization / Purpose / Need

A. Study Authorization

The development of the *Inner Belt Loop Connection Engineering Planning Study* was authorized by the Billings City-County Planning Department, through authorization from the local Technical Advisory Committee (TAC) and the Policy Coordinating Committee (PCC). Authorization to proceed with the study development was granted through a contract dated October 29, 2004, between the Billings City-County Planning Department and HKM Engineering Inc.

The study was funded and administered by the Billings City-County Planning Department through support from the City of Billings and Yellowstone County work programs. Portions of these work program funds are authorized through the Montana Department of Transportation and the Federal Highway Administration each fiscal year beginning October 1.

B. Study Purpose

The process of identifying various transportation corridor alternatives through the development of a planning study centers not only on identifying existing deficiencies within a study area, but also reviewing the potential future transportation needs of the study area, identifying existing and proposed developments within the study area, understanding agency and public perception regarding a new transportation corridor through the study area, and identifying any "fatal flaws" which may preclude continued development of some or all corridors within that study area. Moreover, corridor planning is essential towards fostering cooperative efforts between local planning officials and developers by addressing future transportation needs within a given area.

The planning study process typically analyzes and evaluates alternative solutions based on a predetermined set of criteria, e.g. social and cultural, economic, traffic, constructability, and land use impacts, which ultimately results in a clear set of conclusions and recommendations, leading to the eventual initiation or creation of the project development stage. It is within this stage that more detailed and thorough evaluations of the transportation link are conducted, including alignment selection, development, and eventual construction.

The focal point of this study is to evaluate project feasibility from a technical or engineering perspective (i.e. cost, safety, design considerations, potential impacts, etc.) as well as the level of public support for such a facility. As a result, the evaluation of engineering feasibility was limited to a review and assessment of existing data, preliminary geometric design, and potential project costs. Existing data available for review included project area topographical mapping, aerial photography, approved subdivision plats and subdivision improvement agreements, and approved planning documents and traffic studies related of the corridor. Limited scope field reviews to evaluate existing conditions were also completed including a preliminary review of the site and a preliminary intersection sight distance analysis.

This corridor planning study is a result of continued recommendations from approved planning documents, traffic studies, and citizen advisory groups, as well the continued growth and development of the Alkali Creek area. Specifically, the development of this report serves to satisfy recommendations made by the *1990 Transportation Plan for Billings Montana* and the *Billings Urban Area 2000 Transportation Plan*. Furthermore, continued planning of this corridor addresses traffic issues discussed within the *Rimrock Road & Zimmerman Trail Intersection Improvements Design Study Report* and the *West Wicks Lane & Governors/Gleneagles Boulevard Traffic Signal Design Study Report*. Moreover, this report is expected to complement several current and ongoing planning projects including the Arlene corridor, the Shiloh Road corridor, and the Billings By-Pass corridor.

In terms of addressing continued growth within and adjacent to the study area, the development of a transportation link between the Billings Heights and MT Hwy 3 will serve to effectively and efficiently collect and distribute traffic from and through the study area as current subdivisions continue to expand and as new subdivisions are platted and developed. A long-range analysis of the area's infrastructure including its ability to sustain continued population growth was not analyzed.

C. Project Need

Several factors demonstrate the need to develop a corridor planning study for a new transportation link between the Billings Heights and MT Highway 3. Some of these reasons include the following:

- Promote the safe and efficient movement of traffic through the area and between the Billings Heights and MT Hwy 3

- Address the continued and steady growth in the Billings Heights urban area as well as new growth along Montana Highway 3 and within the Alkali Creek area at rates typically equal to or greater than Billings proper

- Address ongoing and planned development within and adjacent to the proposed study area

- Development of a new transportation corridor that:

    - improves area linkage, provides access to an existing rim crossing, develops access and mobility within the immediate area, and affords improved emergency vehicle access

    - is suitable for the interconnection of utilities between Montana Highway 3, Alkali Creek Road, and the Billings Heights

    - relieves congestion on existing routes to and from the Billings Heights

- To satisfy objectives of approved local planning documents including the *1990 Transportation Plan for Billings Montana* and the *Billings Urban Area 2000 Transportation Plan* including recommendations for continued study of an inner belt loop concept

- To address recommendations made through a survey of Heights residents to develop a link between the Billings Heights and Montana Highway 3[1]

D. Study Process

This study reviews the engineering feasibility of developing a new transportation corridor between the Billings Heights and MT Hwy 3 by looking at several factors including:

- reviewing the constructability of several study corridors

- identifying fatal flaws related to cultural and archeological instances within each of those corridors

- comparing the potential future attraction of traffic by each corridor in relation to the area wide transportation network

[1] Heights Task Force Survey, http://ci.billings.mt.us/Heights/index.php

- public and landowner perception of the various study corridors

A comprehensive feasibility analysis as recommend by the Federal Highway Administration's (FHWA) publication *Procedural Guidelines for Highway Feasibility Studies (Sept 1998)* was not considered necessary for this study as Federal funds administered by FHWA are not currently programmed for the ultimate development of this corridor. Moreover, the identification and preservation of an "Inner Belt Loop" corridor is considered by the Billings City-County Planning Department to be essential for the Billings area transportation network regardless of potential development and construction costs. As such, the development and review of the project's potential benefits to the project's potential costs (the Benefit-Cost or B-C ratio) as recommended by the FHWA has not been identified as a project requisite. Should specific Federal funds become necessary to complete the project, the determination of a B-C ratio may be necessary.

Each of the corridors studied throughout this process has been evaluated based on the development of a comparison matrix that evaluates a series of basic *measures of effectiveness* (MOE's) to determine the most desirable corridor for continued preservation and development. A MOE is generally defined as "a quantitative parameter used to measure the performance of a system or a facility". For this study, the basic MOE's used to evaluate the various corridors include:

- Constructability in relation to the areas geography and topography
- Landowner perceptions and comments through individualized input
- Instances of cultural or archeological concern
- Planning level traffic analysis based on the most current Montana Department of Transportation traffic model for the Billings area
- Planning level project cost comparisons
- Public perceptions and comment through the distribution of information

II. Project Location and Background

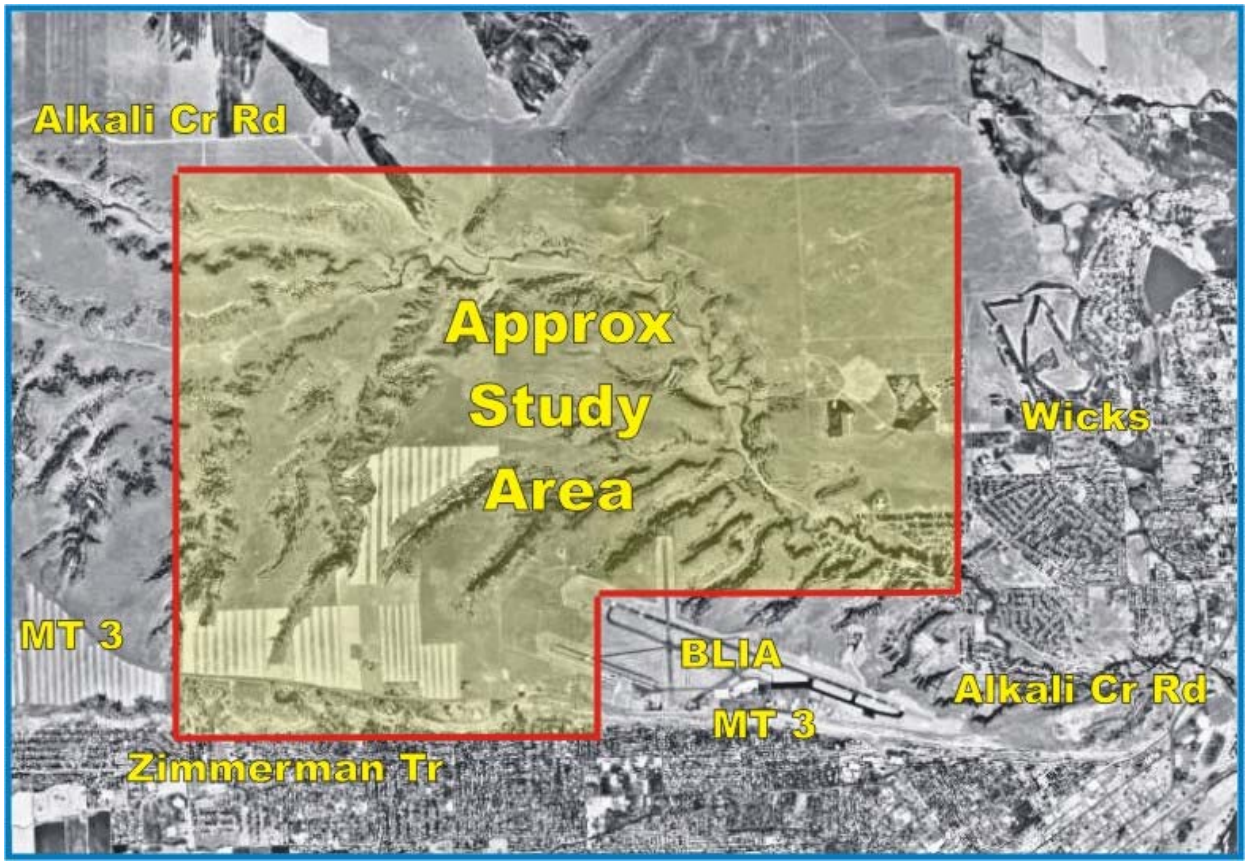
A. Project Location

The broad study area for the Inner Belt Loop Connection Planning Study can be generally described as the mostly undeveloped area west of the Billings Heights and north of Montana Highway 3 encompassing the Alkali Creek drainage, bounded to the south by the Billings Logan International Airport, and wholly within Yellowstone County, Montana. The project study area is approximately 15 square miles, encompassing the following geographical area:

- Township 1 North Range 25 East in Sections 10-15, 22-24, and portions of 26 and 27, Montana Principle Meridian (MPM)

- Township 1 North Range 26 East in Sections 7, 8, 17-19, Montana Principle Meridian (MPM)

Figure 1. Project Study Area



The study area is generally rural in nature and is characterized by sporadic residential development interspersed among dry land farming and grazing operations. Also located within the study area is the Billings Logan International Airport located along the southern boundary of the project area, the Rehberg Ranch Estates subdivision development situated adjacent to the western edge of the study area (characterized by medium density residential housing with accommodations for future neighborhood commercial development), and the Billings Rod and Gun Club which offers several shooting facilities for guns and archery.

The most prominent geographical feature in the study area is the Alkali Creek drainage fed by numerous unnamed tributaries and several perennial springs creating Alkali Creek which ultimately drains to the Yellowstone River. The drainage encompasses most of the study area, while Alkali Creek is situated generally in the northern half of the study area. Areas directly adjacent to Alkali Creek are subject to flooding events, and are classified as a "special flood hazard area" by the Federal Emergency Management Agency (FEMA). Several of the dry tributaries south of Alkali Creek are situated within deep ravines and coulees which would require substantial bridge structures to span. These ravines and coulees are characterized by steep slopes and sandstone outcroppings similar in nature to the prominent sandstone "rimrocks" that traverse the southern edge of the study area, but on a lesser scale.

Several principal arterials are located within the study area. Montana Highway 3 (MDT designation N-53) traverses the study area along the southern boundary of the study area and provides a vital link from rural areas northwest of Billings and the Billings Logan International Airport to the Billings central business district. On a national level, MT HWY 3 is a vital link within the *Camino-Real* international trade corridor, linking Canada, the United States, and Mexico.

Located within the study area is Alkali Creek Road, identified as a principal arterial within the *Billings Urban Area 2000 Transportation Plan*, which provides regional access from areas northwest of Billings to the Billings Heights, as well as residential areas along the eastern portion of Alkali Creek Road.

Wicks Lane (MDT Urban Route designation U-1012) is an east-west principal arterial, and is considered an important transportation link within the Billings Heights as it serves to collect and direct local traffic on both sides of Main Street (MT Hwy 87, MDT designation N-16). Currently, the western terminus of Wicks Lane is located at the eastern edge of the project study area.

Zimmerman Trail (MDT Urban Route designation U-1001), located southwest of the study area, serves to move traffic between the valley of the west end of Billings and MT Hwy 3 situated on the plateau above the sandstone rimrocks. Zimmerman Trail is characterized by a circuitous alignment and steep grades approaching 8%.

B. Project Background

The development of a transportation link between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail has been an element of local planning documents for several decades. The *1990 Transportation Plan for Billings Montana* began to seriously look at the inner belt loop concept by identifying a transportation linkage deficiency between the Billings Heights and the Billings west end. This transportation plan reviewed specifically the concept of an inner belt loop within an "alternate test network" based on a computer traffic model for the City of Billings which was maintained by the then named *Montana Department of Highways* (now known as the Montana Department of Transportation or MDT). Based on this evaluation, development of an inner belt loop was identified as a long-range improvement project to be considered just beyond the documents 20 year planning horizon (year 2010).

In the *Billings Urban Area 2000 Transportation Plan*, the inner belt loop concept was again addressed, with some form of the inner belt loop concept included in 5 of the 6 traffic model scenarios (identified as Alternative Package 1 through 5, and Preferred Alternative Package 6). This plan also determined that the concept of an inner belt loop was an important long range plan project that would serve to improve local and regional mobility, as well as contributing to the overall reduction in area-wide accidents by relieving congestion. Both the 1990 and 2000 plans recommended that a planning study be undertaken to review the concept of an inner belt loop between the Billings Heights and MT Hwy 3.

In 2004, it was determined by the Billings City-County Planning Department that the establishment of an Inner Belt Loop Connection Planning Study project should commence due to continued and sustained growth within the Alkali Creek area, and proposals were solicited from engineering firms for the development of an engineering planning study.

III. Study Approach and Management

A. Study Approach

As noted, the purpose of this planning study is to provide a review and assessment of available information; to solicit agency, landowner, and public comments and opinions regarding various study corridors; to complete a planning level cultural and archeological survey of the proposed corridors; to review the potential traffic loading for various corridor alternatives; and to develop a planning level opinion of probable development costs. A more comprehensive evaluation of development costs, environmental issues, and benefit analyses of continuing development of the corridor is expected to be performed by subsequent projects, as needed or as necessary, should a project be initiated to develop the corridor in part or in its entirety.

The specific areas of interest for this planning study revolve around the following key project tasks, which are discussed in more detail throughout this report.

- Collection and Review of Existing Information
- Stakeholder, Agency, and Landowner Involvement and Comment
- Cultural and Archeological Survey
- Planning Level Engineering Analysis
- Planning Level Opinion of Cost
- Public Comment
- Conclusions and Recommendations

B. Study Management

This planning study was developed in close consultation with the Billings City-County Planning Department, who oversaw the development of this study and provided technical direction for the development of the project. Key stakeholders were also consulted at the beginning of the study and throughout the study process, including the City of Billings Public Works Engineering Division and Yellowstone County. Additional engineering technical support was provided by the Montana Department of Transportation's *Statewide and Urban Planning* section.

IV. Background Documentation

Background information from several sources, approved documents, and current or completed projects were used in the development of this planning study. The most notable of these documents are described herein.

Planning Documents

Generally, the purpose for the development of these types of documents are to "provide guidance" to local area decision makers for the purpose of the continued and ongoing development of transportation facilities and improvements throughout the Billings urban area. Planning documents of this type relative to the Billings area have been continually updated since their formal inception in 1961.

For this study, the following planning documents were reviewed for content and direction:

- **1990 Transportation Plan for Billings Montana** - The concept of a developing a principal arterial "inner belt loop" connection between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail was identified by this Plan as an future essential link within the Billings area transportation system. This Plan recommended implementation of a planning study by year 2000 and development of the corridor within the list of long range improvement projects for the City of Billings beyond the year 2010. A planning level estimate of cost for development was listed as $21,900,000.

- **Billings Urban Area 2000 Transportation Plan** - The year 2000 update to the 1990 Plan also reviewed the concept of a principal arterial "inner belt loop" connection between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail. This linkage was identified through its inclusion within the "Preferred System" traffic model, which incorporated the best elements of the 2000 Plan's various traffic modeling analyses and "fiscally unconstrained" transportation concepts (those transportation concepts not bound by funding availability and regardless of concept cost). Through the traffic analysis, six (6) different improvement plans for the Billings area transportation network were developed. Of these six, five (5) included some form of a connection linking the Billings Heights with MT Hwy 3 at or near Zimmerman Trail.

  This Plan recommended implementation of a planning study prior to 2010, and development of the corridor within the list of long range improvement projects for the City of Billings beyond the year 2020. A planning level estimate of cost for development was listed as $12,800,000.

- **West Billings Plan, City of Billings and Yellowstone County, MT (2001)** - No specific discussion concerning the development of an inner belt loop concept between the Billings Heights and Billings west end was included in this document.

- **2003 Growth Policy, City of Billings and Yellowstone County, MT** - No specific discussion concerning the development of an inner belt loop concept connecting the Billings Heights and MT Hwy 3 was included in this document, although the concept is briefly mentioned.

Traffic Accessibility Studies

Within the study area is the Rehberg Ranch Estates subdivision development. This mixed-use development is expected to encompass approximately 1.25 Sections of land (approximately 800 acres), and is generally located north of Zimmerman Trail, south of Alkali Creek Road, and west of the Billings Rod and Gun Club and the Billings Logan International Airport. The *Traffic Accessibility Study* for *Rehberg Ranch Estates Subdivision* and subsequent addendums include specific discussion items related to the inner belt loop concept, including the acknowledgement that the inner belt loop may bisect the planned development. Moreover, these traffic accessibility studies (TAS) recommend that a section of the inner belt loop between MT Hwy 3 and the subdivision be constructed in combination with the development of the 3rd filing of the Rehberg Ranch Estates subdivision due to the expected generation of vehicle trips by the development and as a means of providing alternative access to and from the subdivision.[2] Further discussions regarding the traffic components of these TAS's are included in the *Final Corridor Development* section of this report.

Design Study Reports

For this study, the following design study reports were reviewed for content and direction:

- Design Study Report for Rimrock Road & Zimmerman Trail Intersection Improvements, Marvin and Associates, May 2003

- Design Study Report for West Wicks Lane & Governors/Gleneagle Boulevard Signal Design, Marvin and Associates, March 2005

[2] *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision*, The Transportation Group, November 3, 2003

Both reports contain some discussion and analysis regarding the future development of an inner belt loop connection between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail. Specific discussions regarding these two reports are included in the *Final Corridor Development* section of this report.

Accident Data

Accident data for the transportation network was not collected or analyzed for this study.

V. Preliminary Corridor Analysis

A. Preliminary Corridor Identification

At the project outset, a coordination meeting with available project stakeholders was conducted prior to the initial phase of the study development. This initial meeting served to define the project study area, provide input towards chronological events and historical data relevant to the planning study, and to provide input towards the development of preliminary corridor routes. Based on this information, topographical maps of the study area, complete with ownership boundaries and available subdivision platting, were created for consideration with the Billings City-County Planning Department, and for use is discussing this planning study with the various landowners within the planning study area. Landowner boundaries and contact information was created based on ownership data collected from the Yellowstone County assessor, and are depicted in Figure 2 herein.

The initial focus of this planning study was to develop and evaluate several corridor alternatives by selecting likely corridor routes based on the geography and topography of the study area, available land and ownership data, and meetings with the project stakeholders. It was determined that once these corridors had been selected, a "screening level" examination of those routes could be conducted for the purpose of identifying those corridors with the least likelihood of continued development based solely on the corridors ability to traverse the topography of the area. As such, any corridors or corridor segments unable to meet this basic criterion could be dropped from further consideration. Through this process, eight (8) basic preliminary alternative corridor routing segments were developed for further study and are described in more detail below. Each of the segments has the ability to combine with other segments to form a continuous corridor through the study area. A graphical representation of the corridor segments overlaid on the planning study area is depicted on Figure 3.

Preliminary Corridor Segment A - This corridor, depicted in BLUE (■ ■ ■ ■), would intersection MT Hwy 3 just west of the Billings Logan International Airport (BLIA), sharing a boundary with private Parcels 188, 189, and 191, and traversing the study area in a northwesterly direction towards it terminus with Alkali Creek Road. The corridor represents the shortest of the preliminary corridor routes.

Preliminary Corridor Segment B - This corridor segment, depicted in BLACK (■ ■ ■ ■), would intersection MT Hwy 3 at one of two alternative locations, traversing the study area along a natural bench, crossing a dry drainage tributary, and continuing towards an intersection with Alkali Creek Road. At Alkali Creek Road, this

preliminary corridor would climb up from the Alkali Creek drainage and would traverse the bench towards its terminus with Wicks Lane using a portion of Preliminary Corridor Segment **F**. This corridor traverses some of the more difficult terrain within the study corridor.

Preliminary Corridor Segment C - This corridor segment, depicted in RED (■ ■ ■ ■), would share portions of Preliminary Corridor **B** or **D**. Using an alternate routing from Preliminary Corridor Segment **B**, this corridor would traverse the study area in a westerly direction, intersecting with Alkali Creek Road, and using a natural draw to climb quickly towards Wicks Lane. A portion of this corridor could require traversing a substantial coulee.

Preliminary Corridor Segment D - This corridor segment, depicted in CYAN (■ ■ ■ ■), provides an additional alternate routing within Preliminary Corridor Segment **B** and Preliminary Corridor Segment **C** by paralleling a dry drainage which shares a property boundary with the Billings Rod and Gun Club and several residential lots. A portion of this corridor could require traversing a substantial coulee.

Preliminary Corridor Segment E - This corridor segment, depicted in YELLOW (■ ■ ■ ■), would intersect MT Hwy 3 at Zimmerman Trail, traversing the study area along a natural bench and through the Rod and Gun Club property, and continuing towards an intersection with Alkali Creek Road. At Alkali Creek Road, this preliminary corridor would climb up from the Alkali Creek drainage and would traverse the bench towards its terminus with Wicks Lane using a portion of Preliminary Corridor Segment **F**. The portion of this corridor through the Rod and Gun Club property represents the flattest topography of the study corridor, excluding the existing Alkali Creek Road corridor.

Preliminary Corridor Segment F - This corridor segment, depicted in GREEN (■ ■ ■ ■), would intersect MT Hwy 3 at Zimmerman Trail and head northerly towards the Rehberg Ranch Estates subdivision. Within the subdivision, the corridor would follow the natural topography utilizing an existing gravel surfaced road towards Alkali Creek Road. At the corridor's intersection with Alkali Creek Road, the corridor would continue northeasterly and away from the Alkali Creek drainage and would traverse the upper bench towards its terminus with Wicks Lane. This corridor represents the longest of the preliminary corridor routes.

Preliminary Corridor Segment G - This corridor segment, depicted in BROWN (■ ■ ■ ■), provides an alternate routing for Preliminary Corridor Segment **F** by heading westerly from Rehberg Ranch, intersecting with Alkali Creek Road, and using a natural draw to climb quickly towards its terminus with Wicks Lane.

Preliminary Corridor Segment H - This corridor segment, depicted by a WHITE solid line (▭), represents the existing Alkali Creek Road corridor, and provides an alternate routing for Preliminary Corridor Segments **B**, **C**, **D**, **E**, **F**, and **G** terminating at the end of the existing pavement along Alkali Creek Road nearly a mile west of Senators Boulevard. This corridor has the advantage of using an already existing transportation route.

Figure 2. Landowner Parcel Map

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Figure 3. Preliminary Corridor Alternatives

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B. Landowner and Agency Coordination

Upon the development and identification of practical preliminary corridor routes, the next critical phase of the planning study began: presenting the preliminary corridors to the area landowners for consideration and comment.

As of the development of this report, the project study area contained over 100 separate parcels of land (identified as Parcels 101 through 200) under the ownership of over 55 different individuals, estates, corporations, or public entities. It should be noted that this tabulation does not specifically include individual ownership within the developed section of the Rehberg Ranch Estates subdivision, which includes several dozen additional landowners, as none of these parcels are directly influenced by the preliminary study corridors.

As is illustrated above, conducting individual meeting with every registered landowner within the study area would be considered impractical given the project budget, number of landowners, and considering that several of the landowners reside out of state. Therefore, a program was developed to discuss the planning study first with the landowners that control the largest land holdings in an effort to ascertain if any of the preliminary corridors could be discounted or removed from further study, thereby reducing the number of landowners that would require direct discussion. Individual landowner meetings with these individuals, organizations, or agencies were conducted throughout the planning process to facilitate discussion on the project, and to identify any areas of concern regarding the remaining corridors from the landowner's perspective. Comments collected during these meetings were used to further evaluate and screen the remaining planning corridors. Through this process and based on these discussions, several of the preliminary corridors were removed from further study.

A summary of these meetings is presented below:

- **Billings Rod and Gun Club** - The Billings Rod and Gun Club operates several shooting ranges on approximately 0.5 square miles in the southwest portion of the project study area. A presentation detailing the purpose, scope, and objectives of the Inner Belt Loop Connection planning study was included in the regular agenda of the Billings Rod and Gun Club's board of directors meeting on Tuesday, January 18, 2005. It was determined at this meeting that the location of a corridor either through or directly adjacent to their property would be detrimental to their organization and operation, and could pose a serious safety concern based on the direction of their various ranges (Preliminary Corridors **D** and **E**). A corridor located west of their facilities

was thought to be the most practical. Regardless, the concept of an inner belt loop through the study area was generally well received. A letter of position from the president of the Rod and Gun Club is included in **Appendix III** of this study.

- **Billings Logan International Airport (BLIA)** - The BLIA maintains several square miles of property within and adjacent to the study area for the purpose of commercial and general aviation. A meeting detailing the purpose, scope, and objectives of the Inner Belt Loop Connection planning study was conducted on Wednesday, February 2, 2005 with the BLIA Engineering and Facilities Planning Manager. Of the corridors presented, several were either in direct or indirect conflict with airport operations or airport safety. Directly impacted would be the BLIA fire-fighting training area within the northwest portion of their property.

  Indirectly, several of the corridors (Preliminary Corridors **A**, **B**, **C**, **D**, and **E**) were located either in the runway protection zones (RPZ) or the runway transitional zones (RTZ) of either the main runway (R 28-10) or the general aviation runway (the primary approach zone for the precision instrument Runway 28-10 extends 10,000 feet horizontally from the runway and vertically at a rate of 50H:1V). The *Runway Protection Zone* is a trapezoidal shaped area which has specific land use limitations in order to keep the approach to an airport runway clear of obstacles. It is comprised of the *Object Free Area*, the *Extended Object Free Area*, and the *Controlled Activity Areas*. The RPZ's are required by the Federal Aviation Administration to be kept clear of structures and development, while the RTZ's have strict guidelines on development as well as limitations to structure heights. Typically, any development within an RPZ is discouraged. Moreover, the BLIA is uncertain about the development of a transportation facility through the RTZ as it may introduce headlight glare that could influence the landing or takeoff operations of the airport's main runway.

  The BLIA has no objection to the remaining preliminary corridor alternative (Preliminary Corridor **A**) that is located outside of the main runway RPZ and RTZ.

- **Private Ownership** - Of the private ownership within the planning study area, the majority of the land is owned by nine (9) primary landowners. Interviews, correspondence, and meetings with these nine landowners were conducted over a seven month period. Discussions with these landowners are detailed as follows:

1. **Owners of Parcels 116, 117, 118, 119, & 134** - A meeting was conducted on Wednesday, January 12, 2005, to discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. The landowners noted that a potential future public school site has been considered located along the northern boundary of Section 22 on what is currently identified as State lands, and that an inner belt loop could assist with the continued planning of that site. It was also suggested by the landowners that a corridor route extending from the easterly boundary of the mid point of Section 15 and heading due east towards Wicks Lane would make the most sense by minimizing the overall corridor distance. The landowners were generally positive towards the continued development of an inner belt loop corroder, noting that a corridor through their property had been anticipated for some time.

2. **Owner of Parcels 165 & 166** - A telephone meeting was conducted on Tuesday, January 18, 2005, to explain and discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study with the registered owner of these parcels, who resides out of state. This landowner is agreeable to the project and to preliminary corridor segment **F**. Although it was noted that the parcel of land in question has been in this owner's family for many years, this owner also understood the development potential of the parcel. An electronic depiction of the study area and preliminary corridor segments was sent to this landowner for further consideration.

3. **Owner of Parcels 104 & 108** - After several telephone conversations, a meeting was conducted on Thursday, January 27, 2005, to discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. This landowner noted the recent development of an emergency access road through the owners property to Alkali Creek Road from the Rehberg Ranch development, acknowledging that this existing road was a logical corridor. This landowner continued by stating that a corridor along this route would be the preferred alternative of the various planning alternatives currently under consideration (Preliminary Corridor **F**, or the GREEN corridor). In general, this landowner was amicable to the continued development of an Inner Belt Loop concept.

4. **Owner of Parcels 164** - A telephone meeting was conducted on Wednesday, February 2, 2005, to explain and discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study with an agent of the legal

owner of this parcel. It was noted by this individual that the parcel is currently land-locked and must be accessed across adjacent private parcels. The agent feels that the project is worthwhile, and would support the continued development of an Inner Belt Loop concept, especially one that would allow access to the parcel.

5. **Owner of Parcels 120 & 121** - A meeting was conducted on Friday, March 4, 2005, to discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. This landowner preferred a corridor routing that follows the existing emergency access road developed by the Rehberg Ranch subdivision located within this owner's parcel (Preliminary Corridor **F**, or the GREEN corridor). This owner did not agree with the corridor routing heading easterly from Rehberg Ranch identified as preliminary corridor segment **G**, as this owner did not believe a road could be constructed through the bench. Furthermore, this owner thought there may be Native American artifacts including arrowheads and tee-pee rings present through the bench.[3] In general, this landowner was amicable to the continued development of an Inner Belt Loop concept, noting that development in the area is inevitable.

6. **Owner of Parcels 113, 128, & 129** - A meeting was conducted on Friday, March 4, 2005, to discuss the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. This landowner's preferred corridor routing was a combination of preliminary corridor segment **F** south of Alkali Creek Road, and preliminary corridor segment **H** using the existing Alkali Creek Road alignment to access the Heights either through Alkali Creek Road, or via a portion of preliminary corridor segment **C** to Wicks Lane. It was noted by the owner that any corridor which bisected his property would be detrimental to current agricultural ranching operations occurring on the property. As such, this owner was adamantly against the specific portion of corridor segment **F** that bisected his parcels. In general, however, this landowner was amicable to the continued development of an Inner Belt Loop concept, noting that development in the area is inevitable and imminent.

[3] A cultural and archeological survey of the corridor **G** did not find any filed references with Montana SHPO to sites along the bench at the corridor location, nor did the survey find any evidence of cultural or archeological instances above ground in the same location during an above ground survey of the area.

7. **Owner of Parcels 126, 127, 131, 132, & 198** - Several telephone conversations between this landowner and the project team took place between January and June, 2005, including specific discussions regarding the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. This landowner is generally in favor of developing a connection through the area, noting that development of the area is imminent, and is amenable to a corridor through the property providing it was developed in such a way as to provide the best use for his property. A hard copy map of the study area and preliminary corridor segments was provided to this landowner for consideration. Upon review, this landowner's preferred corridor would include segments **F** to **G** to **C** through his property, noting that such a corridor would enhance his parcels future value and potential for development.

8. **Owners of Parcels 102 & 103** - Several emails threads and telephone conversations between the registered owners of these parcels and the project team took place between January and June, 2005, including specific discussions regarding the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. The owners stated that they would be agreeable to preliminary corridor segment **F** through their property based on the current location of the segment located just south and east of an existing diesel storage tank located on their property.

9. **Owners of Parcels 106, 123, 124, and 125** - Several emails threads and telephone conversations between the registered owners of these parcels and the project team took place between January and June, 2005, including specific discussions regarding the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. As the owner resides out of state, several electronic depictions of the study area and preliminary corridor segments was sent to this landowner via email for further consideration. Further contact with this owner could not be established.[4]

[4] Through the course of continued corridor development discussed within this report, only those corridors that make use of the existing Alkali Creek Road corridor have the potential to affect this landowner (Parcel #106).

10. **Owner of Parcel 105** - Several telephone conversations between the registered owner of this parcel and the project team took place between January and June, 2005, including specific discussions regarding the purpose, scope, and objectives of the Inner Belt Loop Connection planning study. As the owner resides out of state, an electronic depiction of the study area and preliminary corridor segments was sent to this landowner via email for further consideration. Further contact with this owner could not be established.[5]

- **State of Montana, Department of Natural Resources and Conservation (DNRC)** - The Montana DNRC controls, maintains, and manages several square miles of State trust lands within and adjacent to the planning study area, identified as Parcels 101, 107, 122, 133, 192, and 199. A meeting detailing the purpose, scope, and objectives of the Inner Belt Loop Connection planning study was conducted on Monday, May 9, 2005 with both the Area Manager and the Area Planner for the DNRC Southern Land Office. Each of the remaining corridor segments was presented to the DNRC, including a discussion on several of the segments that have been removed from further consideration due to previous landowner comments. Of the remaining corridor segments, the DNRC preferred segments **G** (BROWN), which generally crosses the study area in an east-west alignment south of Alkali Creek Road and just east of Rehberg Ranch. Development of this corridor segments would open up DNRC managed land located in T1N R25E Section 14, which currently does not have direct access, and would serve to allow the development of the parcel in the future. The DNRC also had no issues with segment **F** (GREEN) which crosses State lands in T1N R25E Section 12 and 22, and T1N R25E Section 18. A letter of endorsement from the DNRC Area Planner regarding the development of an inner belt loop link is included in **Appendix III** of this study.

It is estimated that approximately 73% of the study area was represented through these meetings. The remaining 27% of the study area either did not contain a corridor, or a corridor was removed from further consideration due to the landowner discussions discussed above.

[5] Through the course of continued corridor development discussed within this report, only **Corridor 3** or those corridors that make use of the existing Alkali Creek Road corridor have the potential to affect this parcel.

C. Preliminary Corridor Selection Matrix

A selection matrix was developed to assist in the identification of any of the preliminary corridor segments which could be precluded from further study, and which preliminary corridor segments should be continued forward through the rest of the study process. This matrix reviewed the preliminary engineering feasibility of each study coupled with landowner and agency comments regarding those corridors. Based solely on this information, several of the preliminary corridor segments were determined to have sufficient reason for removal from further study. The selection matrix is depicted in Table 1.

Table 1. Preliminary Selection Matrix

Corridors	Preliminary Corridor Feasibility Criteria		Action
	Preliminary Engineering Feasibility	Stakeholder, Agency, and Landowner Comment	
Preliminary Corridor A (Cyan)	Conflicts with BLIA, Some Topography Issues	Generally Negative - Conflicts with existing structures and operations	*Discontinue Study of this Corridor*
Preliminary Corridor B (Black)	Conflicts with BLIA, Some Topography Issues	Generally Negative - Conflicts with existing structures and operations	*Discontinue Study of this Corridor*
Preliminary Corridor C (Red)	Some Topography Issues along Western Portion of Corridor Segment , Further Study Warranted	Generally Positive for Most of the Corridor Segment	**Continue with further study**
Preliminary Corridor D (Blue)	Conflicts with Shooting Ranges, Some Topography Issues	Generally Negative - Conflicts with existing structures and operations	*Discontinue Study of this Corridor*
Preliminary Corridor E (Yellow)	Conflicts with Shooting Ranges	Generally Negative - Conflicts with existing structures and operations	*Discontinue Study of this Corridor*
Preliminary Corridor F (Green)	Minimal Issues, Further Study Warranted	Generally Positive for Most of the Corridor Segment	**Continue with further study**
Preliminary Corridor G (Brown)	Minimal Issues, Further Study Warranted	Generally Positive for Most of the Corridor Segment	**Continue with further study**
Preliminary Corridor H (White)	Minor Realignment and Flood Plain Issues, Further Study Warranted	Generally Positive	**Continue with further study**

VI. Final Corridor Development

Of the remaining preliminary corridor segments, three (3) basic corridor concepts were recognized as being feasible for continued review and study. Within these corridor concepts are two alternative Heights area connection possibilities, creating a total of five (5) final study corridor concepts. For the purpose of identification, these corridors are now discussed as **Corridor 1A**, **Corridor 1B**, **Corridor 2A**, **Corridor 2B**, and **Corridor 3**, and are described further herein. Graphical depictions of the final corridor alternatives depicted within the planning study area are presented in Figures 4 through 8.

- **Corridor 1A** - This corridor, depicted graphically in Figure 4, would connect with MT Hwy 3 at Zimmerman Trail and proceeds northerly to Section 15 within the Rehberg Ranch subdivision. Within Section 15, the corridor would turn to the east, exiting Section 15 just north of the section mid-point and would proceed due east towards a redesigned intersection with Alkali Creek Road. It is assumed for the purpose of this study that the south leg of Alkali Creek Road would be realigned into the inner belt loop alignment, while the north leg of Alkali Creek Road would be realigned into the inner belt loop corridor at a right angle. Following the Alkali Creek Road alignment, this corridor would connect with the paved section of Alkali Creek Road approximately 1/2 mile west of the intersection of Alkali Creek Road and Senators Boulevard. Improvements along Alkali Creek Road to Senators Boulevard are not included with this study effort. This corridor contains two (2) major crossings of Alkali Creek.

- **Corridor 1B** - Essentially the same corridor as Corridor 1A, Corridor 1B would intersect Alkali Creek Road at a right angle creating a new 4 legged intersection, and would then proceed easterly, rising towards a connection with Wicks Lane. This corridor contains a single major crossing of Alkali Creek. This corridor is depicted graphically in Figure 5.

- **Corridor 2A** - This corridor, depicted graphically in Figure 6, would connect with MT Hwy 3 at Zimmerman Trail and proceeds northerly to Section 15 of the Rehberg Ranch subdivision. Within Section 15, the corridor would turn to the northeast, exiting Section 15 just north of the section mid-point and would proceed northeasterly along an existing gravel surfaced road towards a redesigned intersection with Alkali Creek Road. It is assumed for the purpose of this study that the east leg of Alkali Creek Road would be realigned to coincide with the inner belt loop alignment, while the west leg of Alkali Creek Road would be realigned to intersect the inner belt loop at a right angle. The corridor would follow Alkali Creek Road until it connects with the paved section of Alkali Creek

Road, approximately 1/2 mile west of Senators Boulevard. Improvements along Alkali Creek Road to Senators Boulevard are not included with this study effort. This corridor contains four (4) major crossings of Alkali Creek.

- **Corridor 2B** - Essentially the same corridor as Corridor 2A, Corridor 2B would diverge away from the current Alkali Creek Road alignment approximately 1.4 miles northwest of the end of the pavement on Alkali Creek Road, and would proceed easterly, rising towards a connection with Wicks Lane. The south leg of Alkali Creek Road would be realigned to intersect this corridor at a right angle. This corridor contains three (3) major crossing of Alkali Creek. This corridor is depicted graphically in Figure 7.

- **Corridor 3** - This corridor, depicted graphically in Figure 8, would connect with MT Hwy 3 at Zimmerman Trail and proceeds northerly to Section 15 of the Rehberg Ranch subdivision. Within Section 15, the corridor would turn to the northeast, exiting Section 15 just north of the section mid-point and would proceed northeasterly along an existing gravel surfaced road towards an intersection with Alkali Creek Road, creating a new four-legged intersection. This corridor would continue northeasterly, rising above the Alkali Creek valley, and would follow the bench towards a connection with Wicks Lane to the southeast. This corridor contains only a single major crossing of Alkali Creek.

Figure 4. Final Planning Corridor 1A

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Figure 5. Final Planning Corridor 1B

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Figure 6. Final Planning Corridor 2A

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Figure 7. Final Planning Corridor 2B

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Figure 8. Final Planning Corridor 3

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A. Environmental Considerations

An abbreviated environmental analysis was conducted within the study area to assess the various characteristics associated with each corridor alternative. A more detailed environmental analysis addressing specific environmental concerns and issues may be necessary through the continued development of an inner belt loop project, and would be addressed through future development efforts.

Although through this abbreviated review process there does not appear to be any obvious environmental "fatal flaws" within the study area, beyond those instances identified by the cultural and archeological survey, environmental issues would still need to be examined as part of any detailed location study involving Federal funding.

Cultural and Archeological Considerations

A cultural and archeological survey was conducted to identify any cultural, historical, or archeological instances that could preclude further continued study of a particular corridor alternative. The local cultural resource consulting firm of **Ethnoscience Inc.** was retained to collect all available background information within and near the project site, and to perform a more detailed surface survey within segments of the five final study corridors.

Prior to a field investigation, background information was obtained as either file information or by direct solicitation from the resource agencies. The **Montana Historical Society, State Historic Preservation Office** (SHPO) was contacted to perform a file search for cultural and historic sites within and adjacent to the project limits. Previous studies were identified by SHPO providing information regarding cultural, historical, and archeological site information within and adjacent to the project study area. General Land Office maps of the study area were also researched for indications of cultural or historical sites. Based on this investigation, it was determined that the study area contained no previously recorded National Register of Historic Places (NHRP) cultural properties or protected sites.

Although much of the project area had not been systematically studied for cultural or archeological instances by previous area projects, several sites have been identified within and adjacent to the study area by the Billings Archeological Society in the 1960's. Of those sites identified and on file with MT SHPO, none are located in direct conflict of the final corridor alternatives.

Upon completion of an available records search, a pedestrian ground field survey of the study area was conducted on May 10 and May 14, 2005. The purpose of this survey was to identify undocumented instances of historical, cultural, and archeological significance within the rim crossings, drainage areas, exposed rock faces, and dry land areas of the final planning corridors. Survey transects were performed at 100-ft (30 meter) intervals and correlated to project maps with handheld global positioning satellite (GPS) receivers accurate to within 3-ft (1 meter). Ground surface visibility varied throughout the survey area from 5% (minimal) in crop fields to 95% (near total) in fallow fields with general visibility rates of 20% to 40%. This visibility rate is generally considered sufficient to identify cultural resources in the Northern Plains.[6]

As a result of the survey, no new instances of historical, cultural, and archeological significance were located by the survey within the final corridor routings. It is important to note, however, that the lack of new instances does not preclude the possibility of unidentified cultural or archeological materials located within or outside the survey corridors.

During the course of investigation, an unregistered but documented site was investigated further based on comments received by the project team from area landowners. This site (24YL649), recorded by MT SHPO through a site survey form developed in 1993, was initially identified by the then landowner of the site and further documented by the Bureau of Land Management (BLM). At the time of documentation, it was noted that the site contained noteworthy "cultural material scatter" representing approximately 8,000 years of human occupation beginning near the end of the Pleistocene Era. As of this report, this site has not been identified as a NHRP site by MT SHPO.

Based on Ethnoscience's investigations, **Corridor 1A** and **Corridor 1B** do not contain known instances of cultural or archeological concern within their current routings.

[6] "Cultural Resource Investigations of Proposed Roadway Corridor Connections Between Montana Highway 3 and the Billings Heights in Billings, Montana", Ethnoscience Inc., May 2005

Corridor 2A, **Corridor 2B**, and **Corridor 3** contain site 24YL649, which is not currently recognized by MT SHPO as an NRHP eligible site as discussed above. This site, however, has been identified as containing a "high potential… to contain significant intact deposits that would contribute to pertinent archeological research questions".[7] Based on their research, Ethnoscience believes that this site has the likelihood of being considered a potential NRHP eligible site, and should be avoided if possible. If avoidance of the area by an inner belt loop connection is not possible, Ethnoscience believes that that extensive testing may be necessary, consisting of several 1x1 meter testing grids through the area to be disturbed by construction activities excavated at 10 cm levels until sterile deposits are encountered. Depending on the results of this type of subsurface investigation, a plan to mitigate impacts to the area due to road construction may be necessary, with approval of the plan by MT SHPO and possibly by the Denver office of the Advisory Council for Historic Preservation, prior to road construction.[8]

Conclusions of this evaluation are presented in Table 2.

[7] "Cultural Resource Investigations of Proposed Roadway Corridor Connections Between Montana Highway 3 and the Billings Heights in Billings, Montana", Ethnoscience Inc., May 2005

[8] Requirement not applicable to private ownership as long as local, State, or Federal money is not used for the development of the site.

Table 2. Cultural and Archeological Summery

Final Corridor Alternative	Summary of Cultural & Archeological Instances	Action
Corridor 1A	No Significant Instances Noted	Continued development of corridor should have little impact to C&A sites
Corridor 1B	No Significant Instances Noted	Continued development of corridor should have little impact to C&A sites
Corridor 2A	Instances of Cultural or Archeological Significance **within** the Corridor	As identified site is not currently registered as NRHP eligible, development of corridor possible but may not be practical
Corridor 2B	Instances of Cultural or Archeological Significance **within** the Corridor	As identified site is not currently registered as NRHP eligible, development of corridor possible but may not be practical
Corridor 3	Instances of Cultural or Archeological Significance **within** the Corridor	As identified site is not currently registered as NRHP eligible, development of corridor possible but may not be practical

Study Area Environment

The proposed Inner Belt Loop Corridors extend west from Wicks Lane and then south across Alkali Creek to Highway 3 near Zimmerman Trail. The geology along the proposed Corridors can be separated in to two general areas: the areas located above the Alkali Creek Valley and the Valley itself. The soil profile of the areas located above the Alkali Creek Valley generally consists of a veneer of residual sandy soil deposits that cap the massive late Cretaceous Age Eagle Sandstone formation; the sandstone formation which is approximately 250 to 350 feet thick in the Billings area. The residual soils are composed primarily of poorly graded sand, silty sand, and clayey sand deposits, which vary in thicknesses 0 to 10 feet, typically. The soils grade to weathered sandstone, which becomes strong to very strong at relatively shallow depths. The Eagle Sandstone occasionally extends above the ground surface and forms outcroppings of various sizes in the area. The larger sandstone outcroppings form ridges and cliffs that extend into and border the Alkali Creek Valley.

The soil in the Alkali Creek Valley generally consists of alluvium deposits of the Holocene Age underlain by Eagle Sandstone bedrock. The alluvium deposits in the Alkali Creek area range from 0 to 40 feet thick and consist of sand, silt, and clay, which are derived from the sandstone bedrock. The clay soils located in the area of the proposed corridors generally have a low to

very low risk of swelling (Lopez, 2003). Colluvium slope-wash deposits of the Holocene and Pleistocene Age, consisting mainly of sand, silt, and clay, are also present in a few areas at the base of some of the larger Eagle Sandstone rim rocks that form the perimeter along the eastern portion of the Alkali Creek Valley.[9] [10]

A depiction of the surficial geology of the study area is depicted in Figure 9.

Near the confluence of the north and south forks of Alkali Creek are several perennial springs caused by the local offset of the Eagle Sandstone by one of several minor faults in the area. These springs are thought to be the impetus of historic human occupation in the area. (Ethnoscience, 2005)

The principal flora species located within the study area are blue grama, western wheatgrass, needle-and-thread, and sagebrush. Other common species include prickly pear, fringed sagewort, and broom snakeweed. Minor grassland species include sandberg bluegrass, green needlegrass, bluebunch wheatgrass, plains reedgrass, prairie junegrass, and plains muhly. (Ethnoscience, 2005)

Animal species in the area include robin, red-winged blackbird, black billed magpie, grasshopper sparrow, Lapland longspur, Richardson's ground squirrel, white-tailed jackrabbit, pronghorn, mule deer, white tailed deer, striped skunk, deer mouse, sage grouse, red-tailed hawk, ferruginous hawk, and golden eagle. The primary animals located in the region are cows and horses that were introduced into the regions by human settlement. (Ethnoscience, 2005)

[9] *Geotechnical Data Report for 2002 Rehberg Subdivision Water Line Project*, HKM Engineering Inc., August 2002

[10] Area *of Potential Swelling Clay Hazards in the Billings Area, Yellowstone County, Montana*, Montana Bureau of Mines and Geology, Geologic Map GM61-A and GM61-D

Figure 9. Surficial Geology of Billings, Montana

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B. Roadway Geometric Design

Minimum geometric design standards for an urban arterial roadway as defined by the *American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highway and Streets", 2001* and by the *City of Billings and Yellowstone County Subdivision Regulations* design standards were used for the development of the corridors including design speed, minimum radii for horizontal curves, maximum grade, and vertical curvature. Additional support for roadway geometrics was obtained from the *Montana Department of Transportation Road Design Manual*.

Roadway Typical Section

Based on the *1990 Transportation Plan for Billings Montana* and the *Billings Urban Area 2000 Transportation Plan*, the recommended level of development for the inner belt loop is a principal arterial, which is generally characterized as a 4-lane urban roadway section including curb, gutter, and sidewalk, and typically includes a median or two-way left turn (TWLT) lane. A typical road section consistent with the City of Billings and Yellowstone County standard designs was utilized, and is depicted in Figure 11 on the following page. Geometric criteria for this section are summarized in Table 3.

In an effort to account for and to accommodate phased development, the standard urban arterial typical section was modified to a "rural" typical section, whereby the full development of the roadway can be constructed in stages and as budget allows based on a smaller typical section. This modified typical section more closely represents a standard Montana Department of Transportation rural route with 12-foot lanes and 6-ft shoulders. No curb, gutter, or sidewalk is included in this section. For the purpose of this study, the need for guardrail barrier was reviewed and generally included in areas of fill with slopes steeper than 4:1. A depiction of this typical section is provided in Figure 10.

These two typical sections represent the range of probable development between interim development (rural) and ultimate development (urban).

Surfacing was estimated at 4-inches of asphalt pavement over 16-inches of crushed base course throughout the corridors, including estimates for dust palliatives, seal, and prime. Development of a more detailed and site specific pavement design will be determined through future development efforts.

Figure 10. Inner Belt Loop Typical Section, 2-Lane Rural

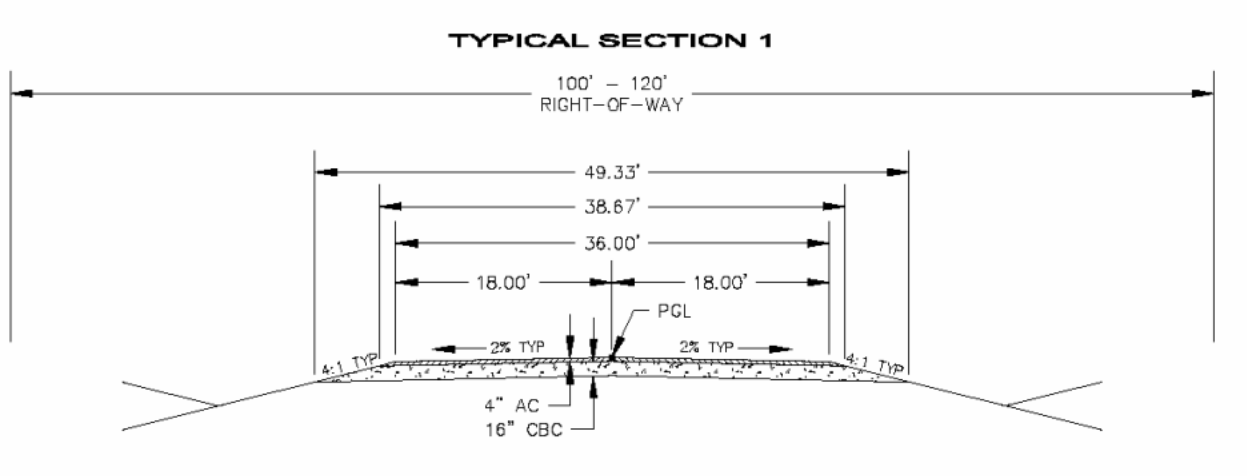
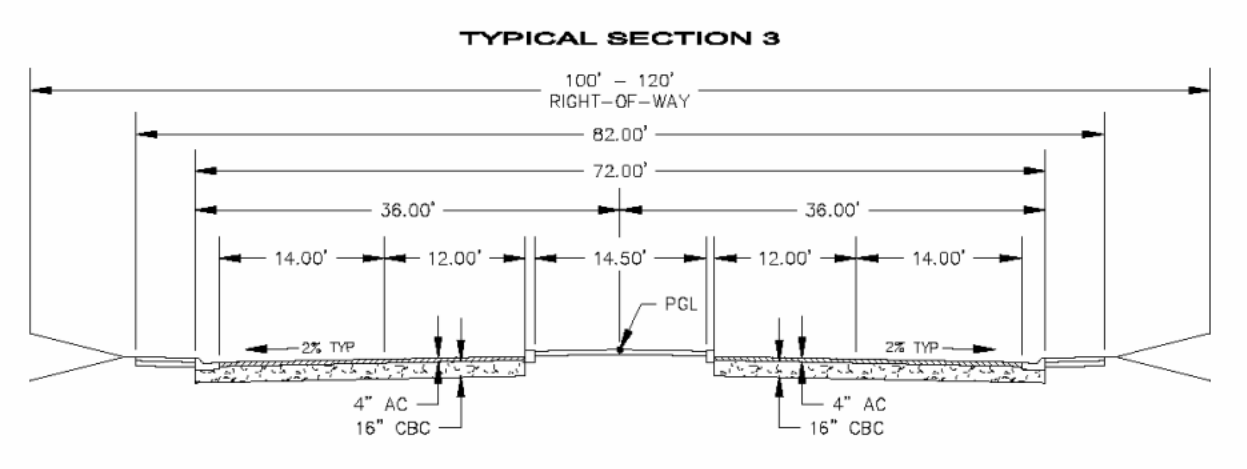


Figure 11. Inner Belt Loop Typical Section, 4-Lane Urban



Roadside Curbing

Along high speed roadways (>45 mph), raised face curb is generally considered an undesirable roadside feature, as errant vehicles could impact these features causing the vehicle to lose control or overturn. Current engineering standards generally recommends against the installation of curb along new construction in rural areas for high speed (>45 mph) rural routes.

As such, curb and gutter have only been estimated for the 4-lane urban roadway section, assuming that the 2-lane section would be posted with a higher speed limit.

Right-of-Way

Obtaining adequate right-of-way is essential to accommodate the construction and maintenance of any transportation facility. The identification of right-of-way early in the planning process ensures project cost savings by identifying the right-of-way needs of a corridor before right-of-way solutions become expensive or cost prohibitive.

The recommended minimum right-of-way width for a principal arterial within the Billings urban area and Yellowstone County is 100-ft to 120-ft, centered on the roadway. Additional right of way may be necessary for detached pedestrian/bicycle/equestrian trails or in areas where large cuts or fills result in construction limits extending beyond minimum desirable widths and where the development of these slopes eliminates the usefulness of the cut or fill area to the landowner. Moreover, additional right-of-way may be required at major intersections to account for dual left turn bays, exclusive right-turn bays, or roundabout installations. For the purpose of this study, right-of-way limits were assumed to be a typical 120-ft, and do not extend beyond this width to anticipated limits of cut and fill.

Earthwork

Earthwork estimates (excavation and embankment) were developed based on the creation of a Triangulated Irregular Network (TIN) developed from established U.S. Geological Survey (USGS) quad maps depicting 20-foot contours and from conceptual alignments within each of the final corridor alternatives. Volumes of excavation and embankment were calculated based on maintaining slopes within the 120-ft right-of-way whenever possible, cross-sections at 25-foot intervals, assumed cut and fill slopes, and using the "average end area" method of volume estimation. A material shrink factor of 25%, based on assumed soil conditions of the area, was used for all segments. It is important to note that through the continued engineering development of a final corridor, and ultimately a final roadway alignment, a more accurate depiction of earthwork volumes will be possible based on improved mapping, detailed geotechnical investigations, and a final typical section or sections.

Table 3. Summary of Geometric Criteria

Feature	Type	Design
Geometric Design Standards	*Standard Arterial (All Sections)*	• 45 mph design speed
		• 7% max grade (45 mph) • 8% max grade (40 mph)
		• Superelevation (e_{max}) = 4%
		• Sag Vertical Curve, K = 64 / 79 (minimum, 40 mph / 45 mph)
		• Crest Vertical Curve, K = 44 / 61 (minimum, 40 mph / 45 mph)
		• Horizontal Curve, 533-ft / 711-ft (minimum, 40 mph / 45 mph)
Right of Way	*Standard Arterial (All Sections)*	• 100-ft minimum; 120-ft recommended
Access Control	*Assumes Limited Control of Access*	
Typical Sections	*Rural 2-Lane Road*	• 2-12 ft. driving lanes
		• 6-ft shoulder (no parking)
		• 1V:6H Foreslopes
	Urban Arterial 2-Lane	• 2-14 ft. driving lanes
		• Sidewalk, Curb & Gutter
		• Raised Median
	Urban Arterial 4-Lane	• 2-12 ft. & 2-14 ft. driving lanes
		• Sidewalk, Curb & Gutter
		• Raised Median
Alignment	*Preliminary corridor layout only, no specific alignment location is recommended for this level of effort and study.*	
Phasing	*As determined by local agencies and development.*	

Structures

No substantial bridge structures are anticipated for any of the remaining corridors. Several large drainage structures are considered necessary, however, to span either Alkali Creek or the unnamed dry tributaries that feed Alkali Creek. A detailed drainage investigation addressing specific drainage concerns and issues will be address through future development efforts. For the purpose of this study, drainage structures were give a cursory review based on FEMA 100-year and 500-year flood plain maps of the Alkali Creek area.

C. Traffic Projections and Considerations

Traffic Model Analysis

Specific or detailed traffic analysis efforts to expressly review the potential traffic loading of an inner belt loop concept have not been undertaken prior to this study effort, except for planning level analyses within both the *1990 Transportation Plan for Billings Montana* and the *Billings Urban Area 2000 Transportation Plan*, both of which considered how a link between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail could affect the overall travel characteristics within the entire City of Billings transportation network. Traffic analyses included in both of these documents indicated the need for advanced planning of an inner belt loop link within the long term transportation planning horizon for Billings. Beyond these efforts, several recent traffic studies have considered some level of linkage between the Billings Heights and MT Highway 3, and are discussed herein.

The determination of potential average daily traffic loading of the remaining final corridor alternative concepts (**Corridor 1A**, **Corridor 1B**, **Corridor 2A**, **Corridor 2B**, and **Corridor 3**) was performed in cooperation with the Montana Department of Transportation's (MDT) Planning Section and the Billings City-County Planning Department using MDT's most current Quick Response System (QRS) II traffic model for the City of Billings. It is important to note that the MDT QRSII traffic model used for this study is the same model that is being used by several ongoing planning projects including the *Shiloh Road Corridor* project and the *Billings By-Pass* project. As such, no special modifications to the QRSII traffic model were considered as the model is deemed adequate for the needs of this planning project by both the Billings City-County Planning Department and MDT.

It should be noted that the current traffic model has several minor limitations which should be considered while interpreting the model's corridor volume output. In its current configuration, the models base year is characterized by year 2002 traffic volumes. These volumes required minor adjustments to represent various planning study design years based on anticipated independent

growth rates, socioeconomic data, and United States census data. On its own, the manipulation of traffic model data to represent some future event is not generally considered a model limitation, as the manipulation of data is typically performed during traffic model analyses to estimate future conditions based on historical growth trends. However, the use of year 2002 volume data as the base model does not automatically consider changing growth trends which have occurred over the last several years; especially in the area west of Main Street in the Billings Heights as can be illustrated through traffic counts observed by the approved *Study Report for West Wicks Lane & Governors/Gleneagle Boulevard Signal Design* prepared by Marvin and Associates (2005)

Another limitation of the MDT model is that it greatly underestimates existing and potential dwelling units within the traffic analysis zone (TAZ) that encompasses most of the study area, including the Rehberg Ranch subdivision. The importance of accurately estimating dwelling units within a TAZ as well as the potential for growth within that TAZ can dramatically influence the generation of daily trips to and from that TAZ, and therefore the adjacent transportation network. Most notably, the MDT model did not include buildout estimates for the ongoing Rehberg Ranch development. Discussions with Rehberg Ranch personnel indicate estimates for buildout of 1100 dwelling units by year 2027. In an effort to develop a better estimation of demand and volume output, these additional dwelling units were added to the TAZ encompassing the developing subdivision for the corridor model analysis.

The MDT traffic model software utilized for this analysis is also limited in how geography is considered during the assignment of trips to the network. Specifically, the QRSII program typically uses a companion program to build the street network, centroids of traffic analysis zones (TAZs), and the centroid connectors. Typically, an image file depicting the streets within the study area may be used as a background on which the street network is developed. If the scale of the image or mapping is incorrect, the network may assign trips incorrectly. Moreover, the program does not consider the affects of elevation while assigning trips to a transportation link. It was noted by MDT that the traffic software may be overestimating trips to and from Zimmerman Trail while not considering the elevation change and curvilinear nature of the link.

Travel demand forecasting models are often used to estimate traffic volumes on roads and at intersections for planning purposes. Generally, traffic models assume that transportation networks will change in predictable ways over the planning and forecasting horizon as area populations expand. However, uncertainty in forecasting travel demand results from the complexity of the urban system and that urban systems evolution. This produces a level of imprecision as the planning horizon year is extended, and as predictions of population and employment derived from economic assumptions, employment assumptions, household size

assumptions, and commercial development assumptions become less reliable. Longer planning horizons typically deal in general or conceptual planning events with reduced emphasis on detailed or specific results. Simply stated, traffic forecasting becomes less reliable as planning horizons are extended.

Based on the planning nature of this study and the limiting characteristics of the model used to perform this traffic analysis, specific average daily traffic (ADT) volume estimates for each of the model runs should be considered as "planning level" estimates only, and do not necessarily represent the actual ADT that should be expected to utilize an inner belt loop linkage between the Billings Heights and MT Hwy 3. Because of this, and through discussions with City-County Planning, it was determined that the ADT estimates developed by the MDT traffic model would be best used to approximate how each corridor alternative could be expected to load in comparison to each of the other corridor alternatives within the same traffic model and under the same conditions and limitations. In other words, an evaluation of the ADT's reported by the model should indicate which of the corridors could be expected to see more use as compared to the remaining corridors, regardless of the specific volumes reported by the model or limitations within the model. A more detailed and comprehensive traffic analysis of an inner belt loop connection is expected to be performed and completed as part of any detailed location study, including specific discussions and analyses on adjacent developments, potential connection points including internal loading locations, intersection turning movements and levels-of-service, corridor level-of-service, etc.

A graphical representation of the study area network and background average daily volumes as reported by both MDT and Billings City-County Planning for major study area transportation links is depicted on Figure 12.

Each of the final study corridors was modeled based on an assumed ultimate 4-lane urban typical section, 45 mph design speeds, and an above moderate level of access control. Model runs were conducted for the initial model year (2002) and a 20-year horizon (2027), and back-checked with the Billings City-County Planning Department's 2005 traffic count data. Average daily traffic volumes, as reported by MDT, are contained within **Appendix I** of this report. Graphical representations of the MDT inner belt loop linkage (depicted in green) and year 2027 volumes are contained in Figures 13 through 17.

Volume comparisons between corridor model runs containing an inner belt loop connection and the horizon year 2027 model are depicted as a percent-change in potential ADT (either as an increase or a decrease) a particular link could expect with the development of an inner belt loop connection compared to the system without an inner belt loop. While interpreting these

increases or decreases, it should be noted that relatively small initial ADT's (500-2000 ADT) will produce large percent changes with the addition of a relatively small amount of new or redistributed traffic volumes, whereas small percent changes on large volumes (20,000 to 45,000 ADT) may actually represent a significant reductions in potential ADT.

As a result of the MDT traffic model analysis, **Corridor 1B** exhibits the greatest potential to attract the most ADT in relation to the other corridors, and therefore demonstrates a higher level of benefit towards the justification of continued corridor development.

It should be noted that each of the final corridor alternatives loaded similarly between the Rehberg Ranch development and Highway 3 at Zimmerman Trail. Several reasons contribute to the similarity of this linkage. One reason for this similarity can be attributed to the method which the MDT traffic model uses to generate loading within this TAZ, which assumes point loading of all Rehberg Ranch traffic similarly across all corridor alternatives. Secondly, as each of the corridors is essentially the same between these two points, they can be expected to load comparably, with volume differences attributed to the level of "pass-by" traffic using the corridor between the Billings Heights and the Billings west end.

Figure 12. Study Area Volumes, Background ADT (Year 2002)

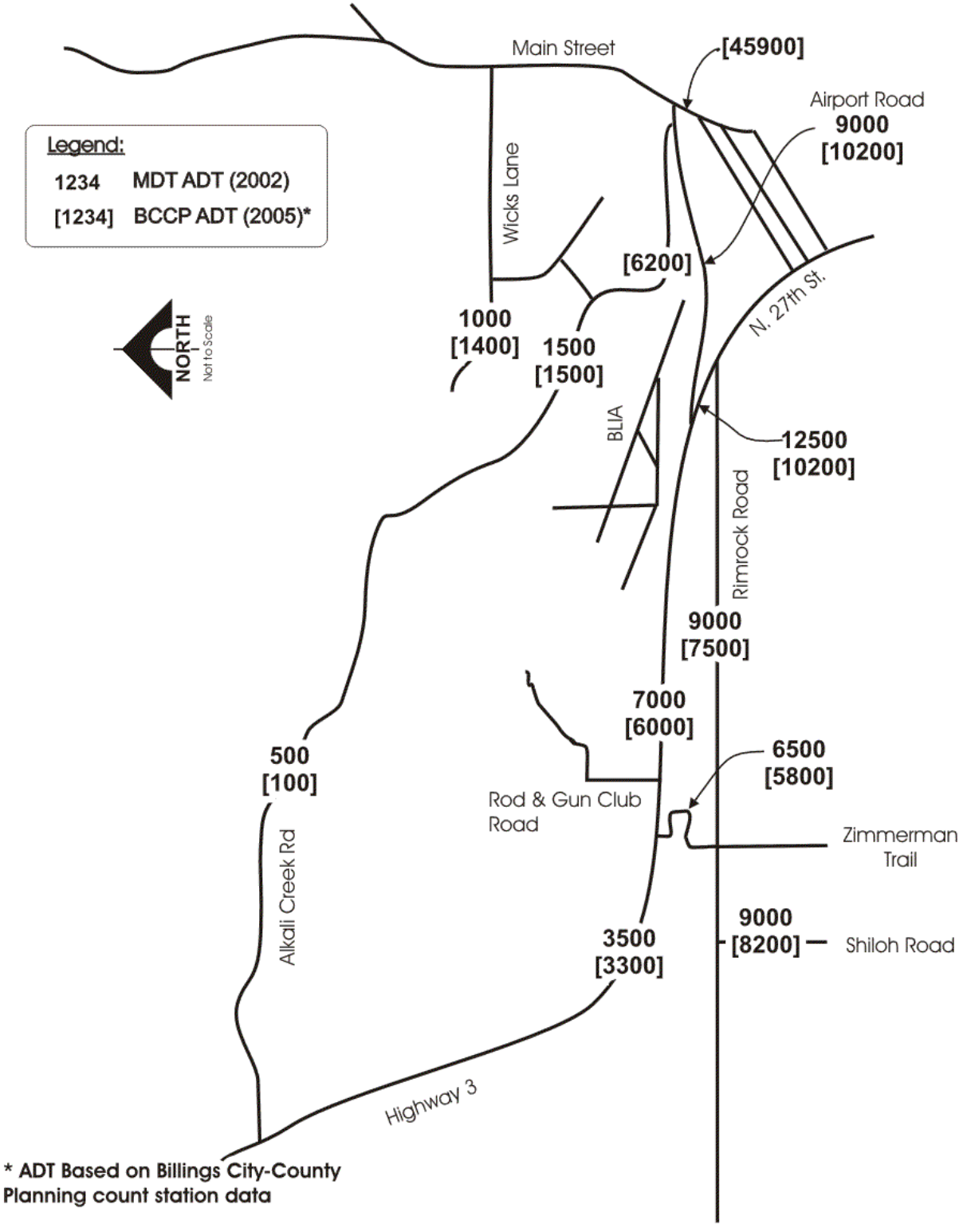


Figure 13. Study Area Volumes, Baseline ADT (Year 2027)

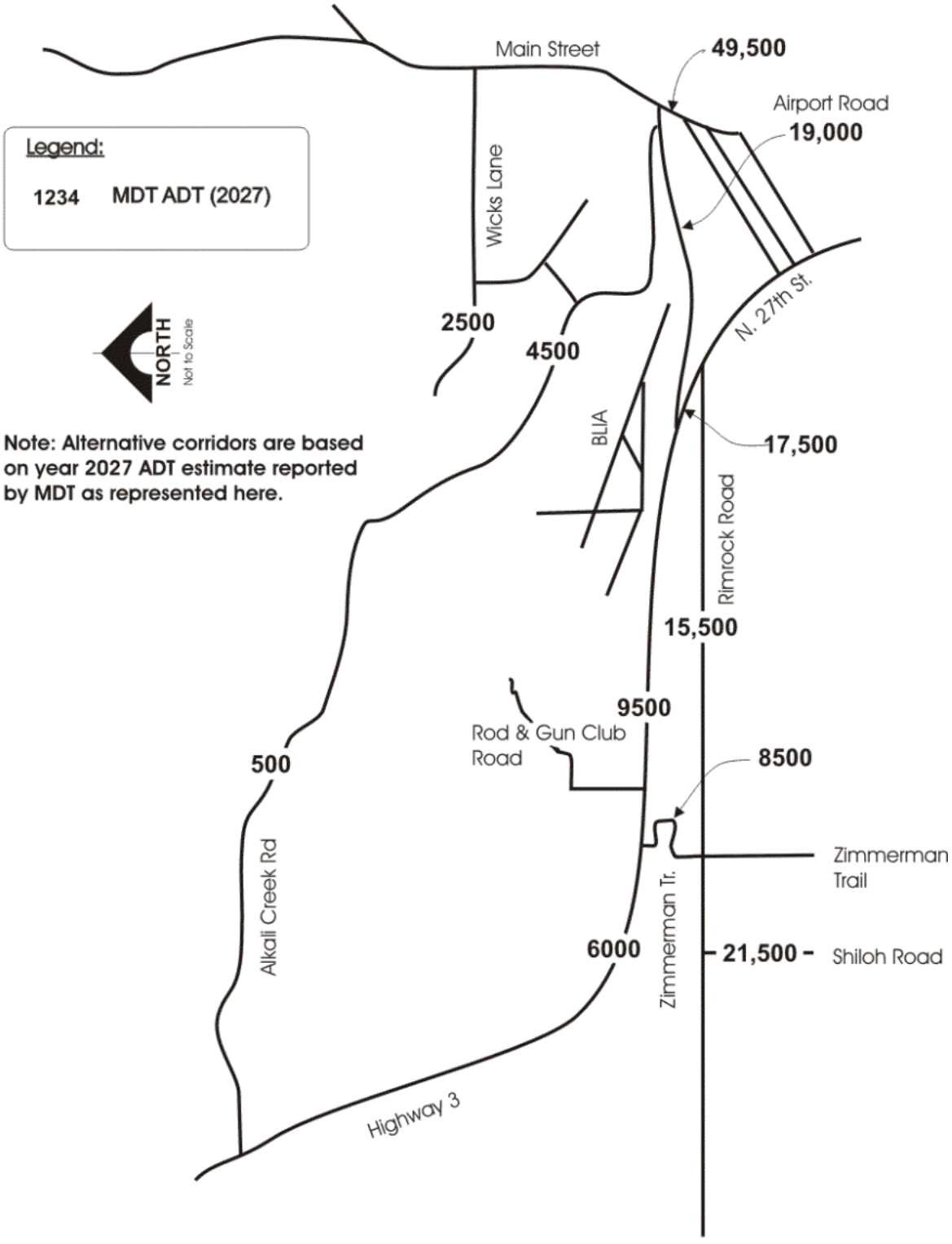


Figure 14. Corridor 1A Expected ADT (Year 2027)

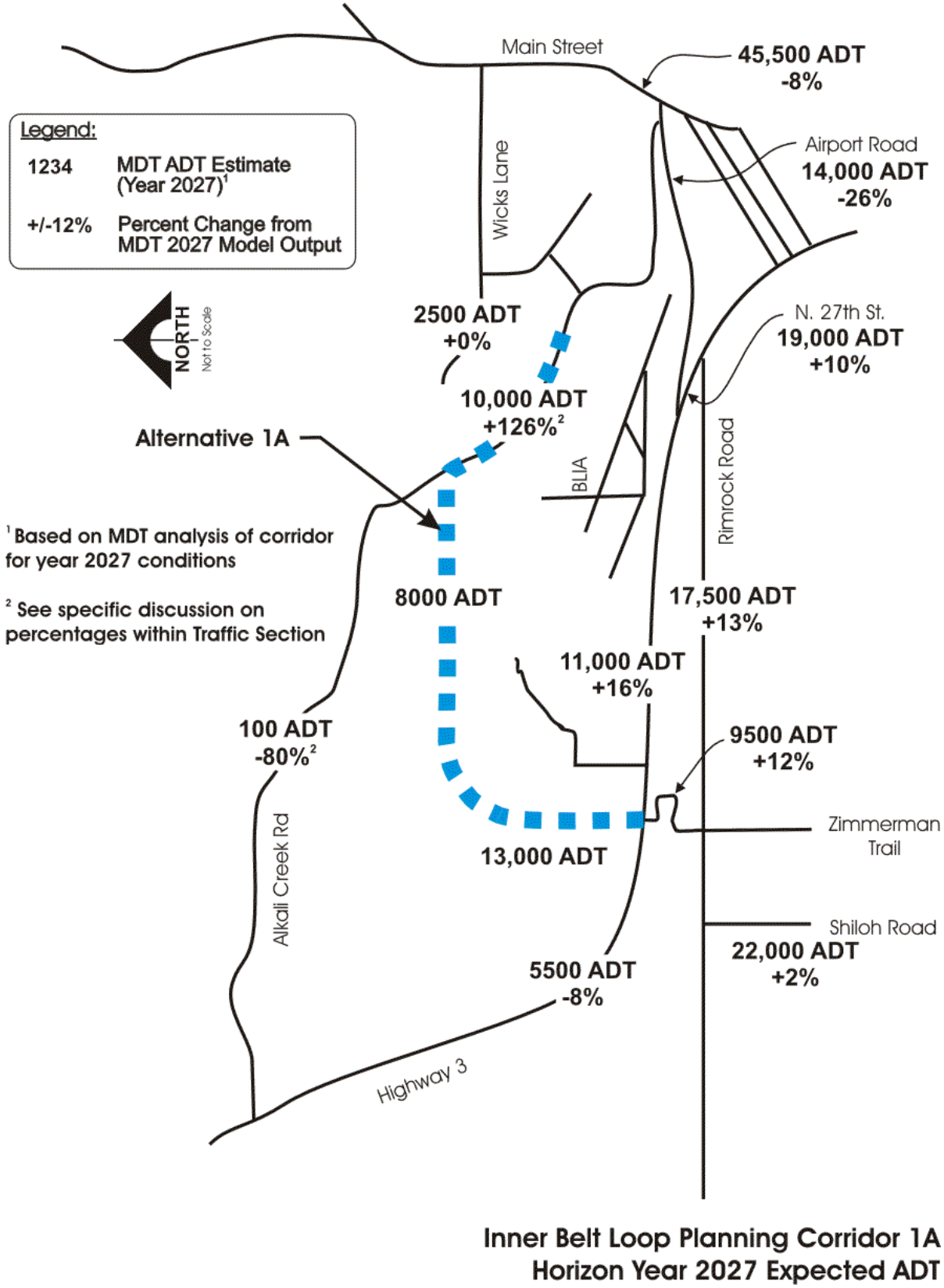


Figure 15. Corridor 1B Expected ADT (Year 2027)

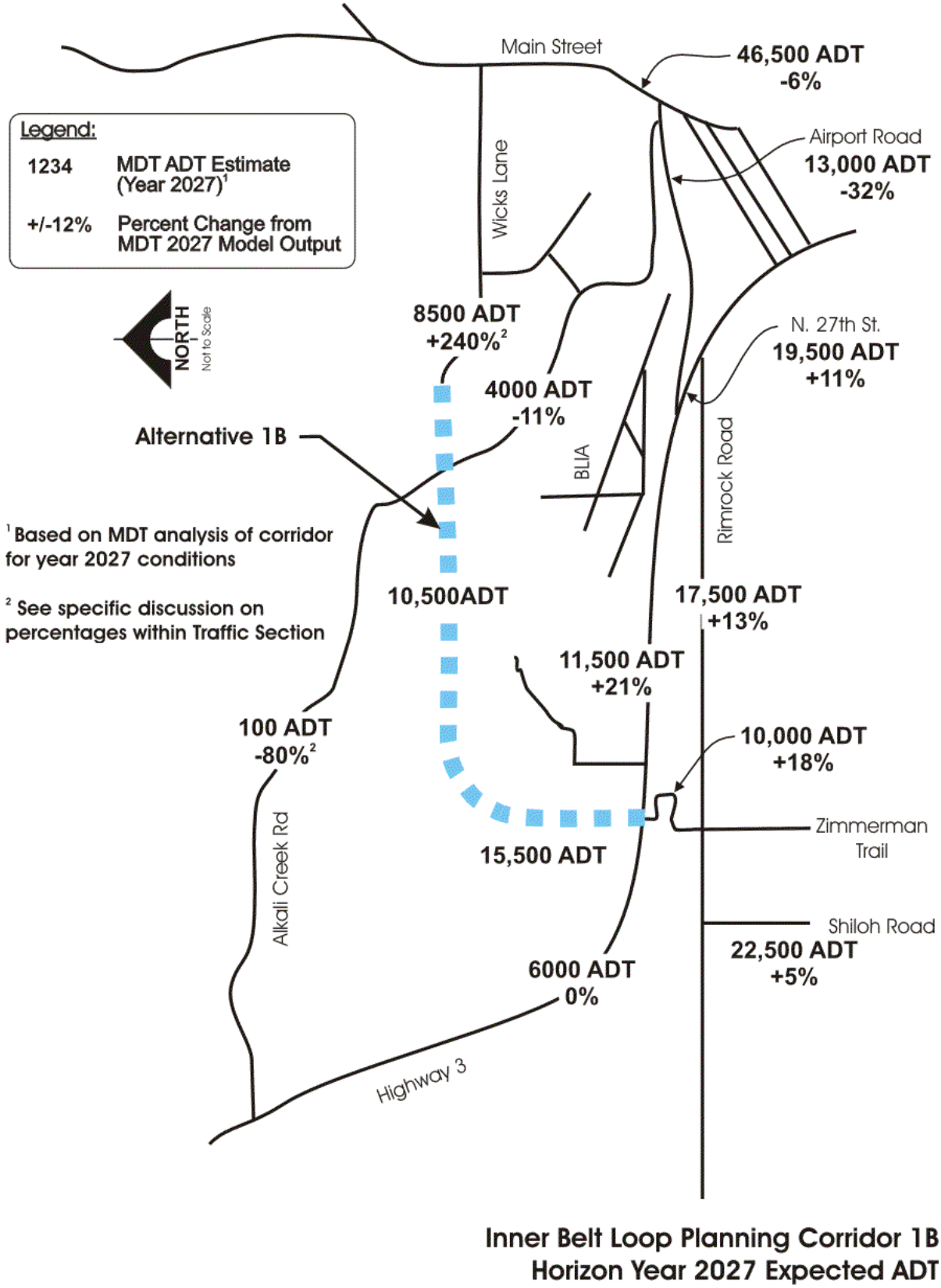


Figure 16. Corridor 2A Expected ADT (Year 2027)

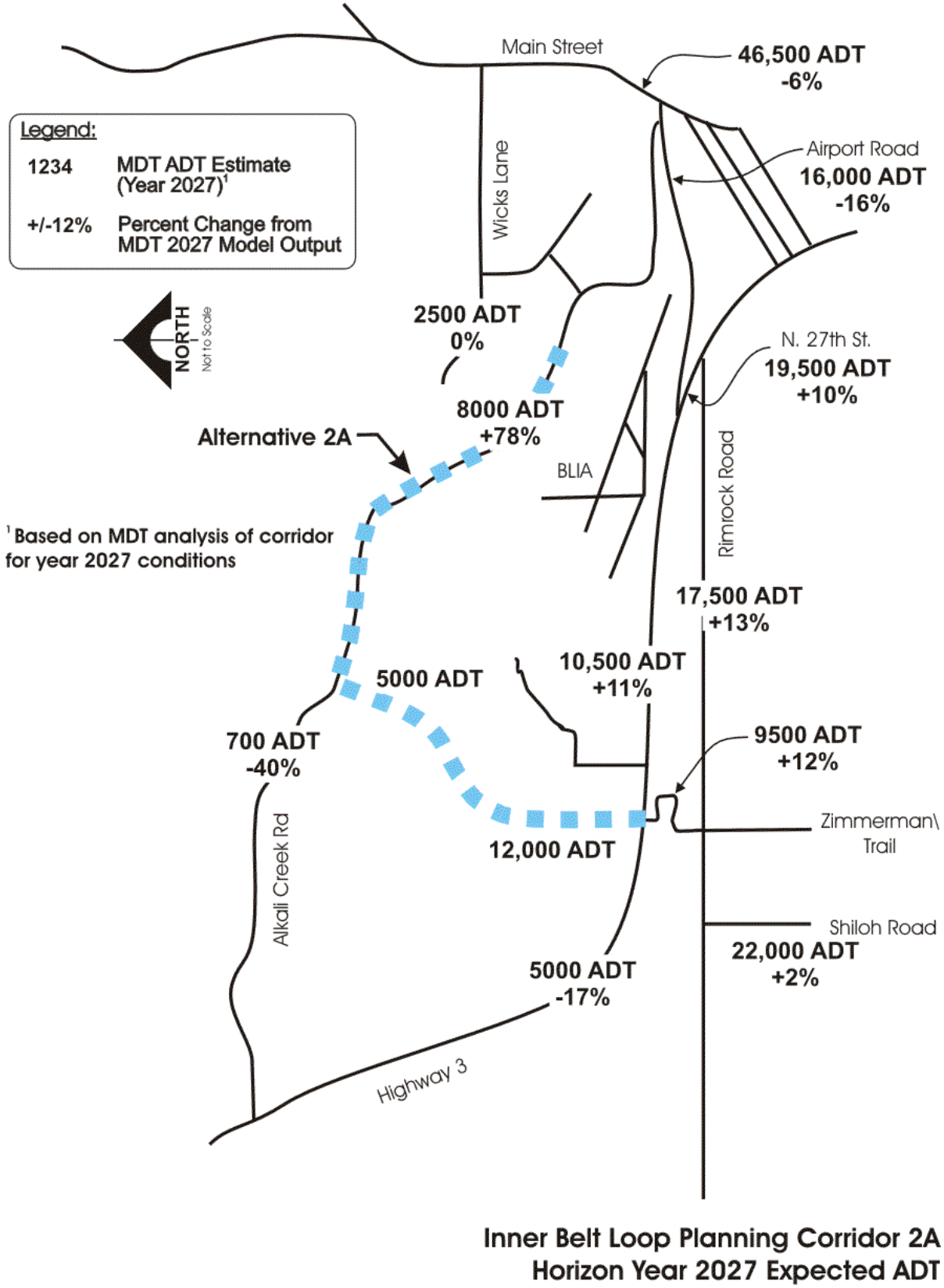


Figure 17. Corridor 2B Expected ADT (Year 2027)

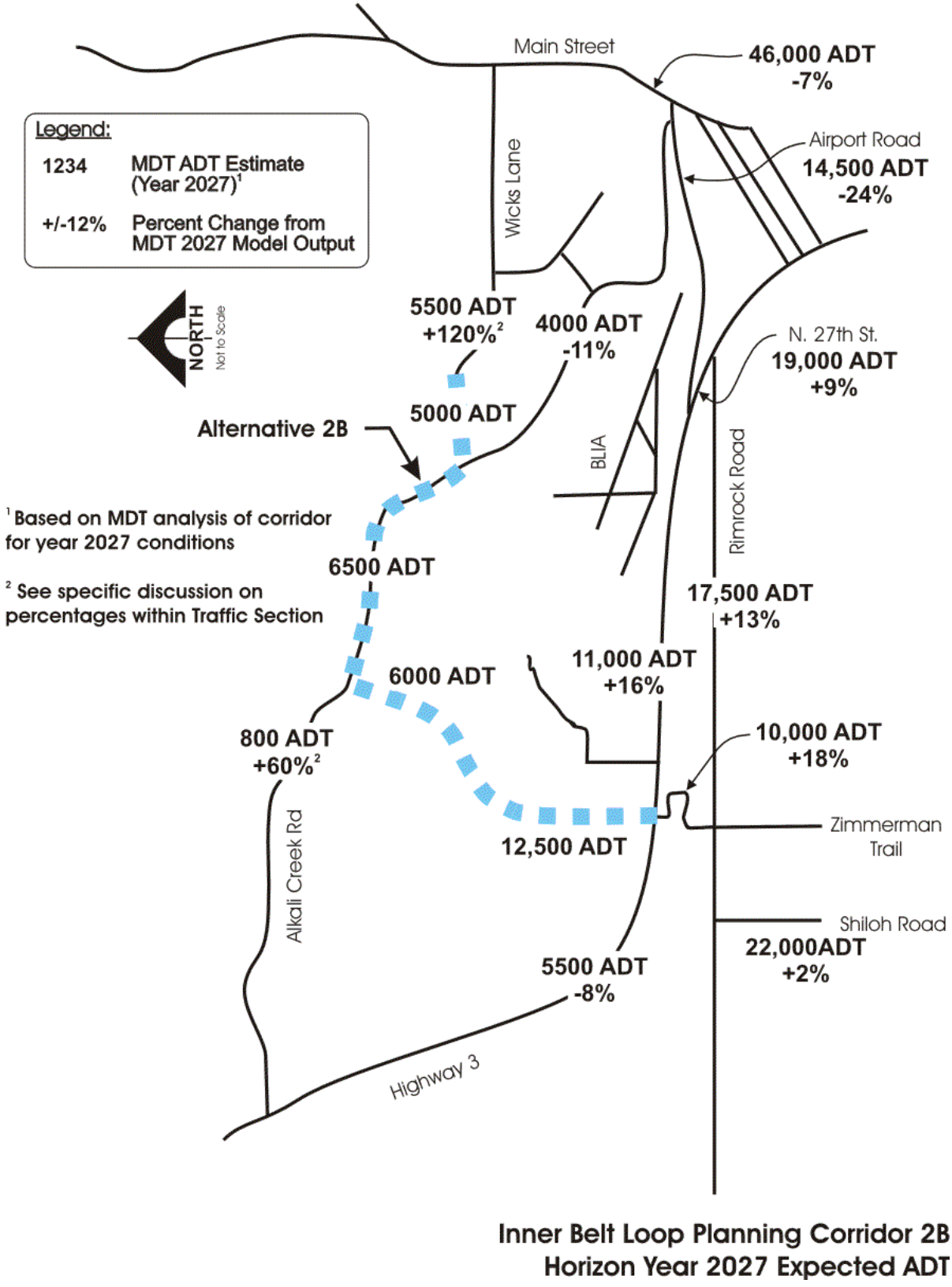
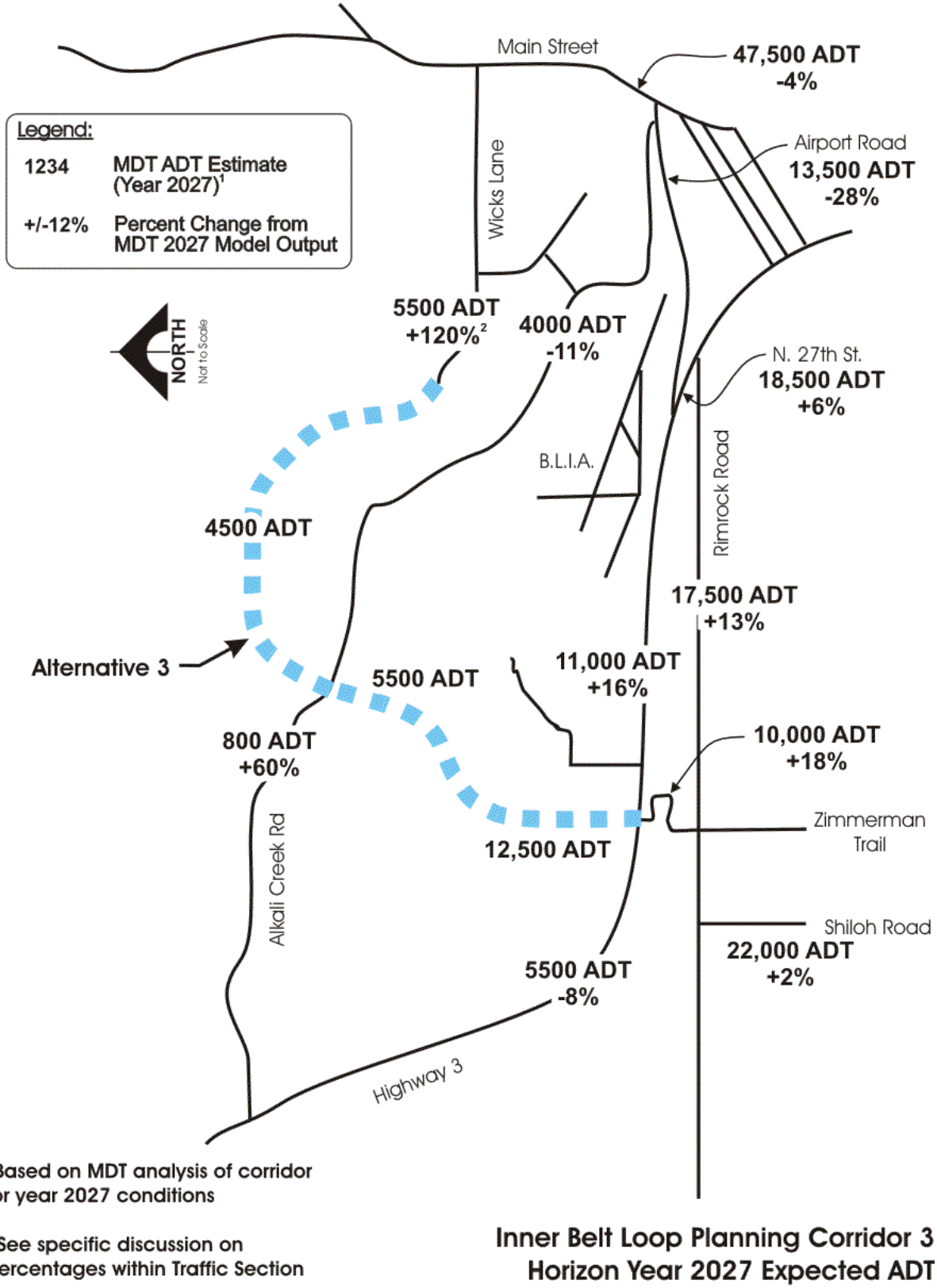


Figure 18. Corridor 3 Expected ADT (Year 2027)



D. Additional Traffic Considerations

As discussed above, the concept of an inner belt loop connection centers on developing an urban arterial through the Alkali Creek area between the Billings Heights and MT Hwy 3. The primary characteristic of an arterial roadway is to provide for a high degree of mobility at the expense of direct access for the purpose of serving longer trips. Essentially, the function of an arterial roadway is to move traffic efficiently through an area by serving not only trips that are passing through an area (i.e. Billings Heights to MT Hwy 3 and vise versa) but also trips entering and leaving the adjacent area (i.e. adjacent subdivisions and commercial developments). This is generally accomplished by higher operating speeds, evenly spaced intersections, a stricter level of access control, and greater capacity. Based on this understanding of arterial roadways, average daily traffic volumes in excess of 12,000 ADT are not unexpected for an inner belt loop connection through the study area. Credence for this statement is supported through expected future traffic volumes as reported by the *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision*, the *Design Study Report for West Wicks Lane & Governors/Gleneagle Boulevard Signal Design*, and the *Design Study Report for Rimrock Road and Zimmerman Trail Intersection Improvements*, discussed herein. It should be noted that as the Alkali Creek area and MT Highway 3 area continues to develop, including residential subdivisions and commercial sites, the inner belt loop could be expected to see more volume than is currently reported by the MDT model.

Rehberg Ranch Subdivision

Assuming that the development of the inner belt loop occurs prior to the complete buildout of the subdivision, the *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision* concluded that a majority of the generated trips from the subdivision adjacent to the inner belt loop would use the inner belt loop rather than Rod and Gun Club Road (the current access point to and from the subdivision) upon its development. The TAS further noted that the development of an inner belt loop could relieve congestion at the intersection of MT Hwy 3 and North 27th Street as well as along Airport Road, since many residents within the subdivision may be inclined to use the inner belt loop to travel to and from the Billings Heights. To illustrate this point, the TAS estimates that approximate 90% of the generated vehicle trips from the subdivision would utilize an inner belt loop (73% to MT Hwy 3 and 17% to the Billings Heights). This statement is supported by the MDT traffic model analysis performed by this inner belt loop planning effort which indicates a reduction in daily traffic volumes along Airport Road and along Main Street.

It should be noted that the *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision* further recommends that as a means of providing alternative access to and from the subdivision

a section of the inner belt loop between MT Hwy 3 and Rehberg Ranch be constructed in combination with the development of the 3rd filing of the Rehberg Ranch Estates subdivision due to the expected generation of vehicle trips by the development. [11]

Wicks Lane

The MDT traffic model reports a year 2002 average daily traffic (ADT) volume of approximately 1,000 ADT, and estimates a horizon year 2027 average daily traffic for Wicks Lane west of Governors/Glen Eagles Boulevard at approximately 2,300 ADT, or a 3.1% average annual growth rate for the area. The Billings City-County Planning Department reports 1,400 ADT for year 2005 (count collected in year 2004). Assuming the same average area growth rate of 3.1% per year for the area adjacent to Wicks Lane, a year 2027 ADT can be estimated at approximately 2,800 vehicles per day.

The *Design Study Report for West Wicks Lane & Governors/Gleneagle Boulevard Signal Design* prepared by Marvin and Associates (2005) collected and reported Wicks Lane ADT during January of 2005 for the westbound movement and the eastbound movement of the west leg of its intersection with Governors/Gleneagle Boulevard as 2,808 and 2,904 ADT, respectively, or a total of 5,712 ADT. This value is substantially higher than those being reported by MDT and Billings City County Planning. Although the reason for the difference in ADT is not readily apparent, discrepancies between these values could be contributed to the time of year the two data sets were collected as well as the continued development of single family homes as well as a large church facility west of this intersection. Regardless, the reported daily volumes identified by this intersection design report are considered accurate.

The Marvin study also provides projections for year 2020 ADT for this leg of the Wicks Lane and Governors/Gleneagle Boulevard intersection as 9,400 ADT. This future projection assumes that: 1) Skyview High School reaches peak enrollment, 2) the area adjacent to this intersection continues to grow at a rapid pace, and 3) the inner belt loop has been constructed by year 2015.[12] By comparison, the MDT model output predicts year 2027 daily traffic volumes for this leg of Wicks Lane of between 5500 ADT and 8500 ADT, assuming a belt loop connection.

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[11] *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision*, The Transportation Group, November 3, 2003

[12] *Design Study Report for West Wicks Lane & Governors/Gleneagle Boulevard Signal Design,* Marvin and Associates, 2005

When comparing the output from the Marvin study and this study, it is important to note that the Marvin traffic model for the Billings area and the MDT traffic model for the Billings area are mutually exclusive. As such, it is reasonable to expect differences in volume outputs between two separate models using separate assumptions. Although the MDT output produces a smaller ADT, the MDT model does not necessarily make the same considerations that the Marvin study does as mentioned above. Regardless, both the Marvin study and the MDT analysis indicate that Wicks Lane should experience a rapid increase in ADT beyond what may be currently expected by using historic ADT estimates and growth rates.

Intersection improvements, including signalization, to the intersection of Wick Lane and Governors/Gleneagles Boulevard are expected to be completed by 2006.

Zimmerman Trail

Through the development of the inner belt loop, volumes on Zimmerman Trail will continue to rise. It was noted by MDT, however, that should be taken while considering and reviewing volume outputs for Zimmerman Trail as reported by the MDT model. Although the model output provides a good indication of the potential demand that could be placed on the Zimmerman Trail link with the development of an inner belt loop connection and as based on current area growth trends, the QRSII traffic model employed by MDT does not effectively consider geographical conditions in determining traffic assignments, such as the steep grade and curvilinear alignment of Zimmerman Trail between MT Hwy 3 and Rimrock Road. Therefore, future volumes reported by the model could be considered conservative. The average daily traffic volume for Zimmerman Trail for year 2002 as reported by MDT is approximately 6,500 ADT, while the City-County Planning reports volumes of 5,700 ADT for year 2005 (collected in 2004). Year 2027 estimates for Zimmerman Trail as reported by the MDT model are approximately 8,500 ADT. Year 2027 volume ranges for Zimmerman Trail with an inner belt loop connection as reported by MDT for this inner belt loop study are between 9,500 ADT to 10,000 ADT, or essentially equal across all corridor alternatives.

The *Design Study Report for Rimrock Road and Zimmerman Trail Intersection Improvements*, prepared by Marvin and Associates (2003), reported a 24-hour volume count of 6,057 ADT collected in October 2002, a year 2013 volume of 7,100 ADT, and a year 2023 volume of 13,800 ADT. The Marvin study assumes that the inner belt loop is connected to Zimmerman Trail prior to the reports design year of 2023, and that roadway linkage improvements to the

south of Rimrock Road (the "Arlene" corridor) have been completed.[13] When comparing the output from the Marvin study and this study, it is important to note that the Marvin traffic model for Billings and the MDT traffic model for Billings are mutually exclusive. As such, it is reasonable to expect differences in volume outputs between two separate models using separate assumptions. Regardless, both models estimate that Zimmerman Trail will see some volume increase with the development of an inner belt loop connection.

Intersection improvements to the intersection of Rimrock Road and Zimmerman Trail, based on the Marvin report and which included signalization and the installation of left turn lanes, were completed in 2005.

The intersection of Zimmerman Trial and MT Hwy 3, as reported by the *Traffic Accessibility Study for Rehberg Ranch Estates Subdivision* (2003), is expected to operate as a satisfactory level-of-service through the development of the first and second filings of the Rehberg Ranch Subdivision. The south leg of this intersection, however, exhibits a grade of approximately 3% at the intersection, and becomes steeper as one travels away from the intersection. Because of this, the TAS recommends relocation of the intersection 150 feet to the north to improve the storage platform of the south leg of the intersection. Discussions with MDT indicate that this alternative is viable and should be considered, especially due to the location of park lands adjacent to and south of MT Highway 3 at this location.

Considering recent improvements to MT Hwy 3 just east of Zimmerman Trail and at Rod and Gun Club Road, other alternatives for improving capacity and level of service at the intersection of MT Hwy 3 and Zimmerman Trail are offered for consideration, each of which involves the construction of an underpass of MT Hwy 3 by Zimmerman Trail and the development of a "quadrant roadway intersection" design modified to allow full movements at the quadrant intersections, and including the installation of modern urban roundabouts. Regardless, relocation of the intersection to the north should still be considered a viable option.

- **Conceptual Intersection Alternative 1** - A "modified" quadrant roadway intersection (QRI) incorporating a modern urban roundabout intersection north of the underpass of MT Hwy 3 by Zimmerman Trail and an at-grade signalized intersection either east or west of Zimmerman Trail. A modified QRI design which incorporates an underpass would allow for the free movement of inner belt loop traffic to and from Zimmerman Trail, while the installation of a roundabout would smooth the progress of the expected inner

[13] *Design Study Report for Rimrock Road and Zimmerman Trail Intersection Improvements,* Marvin and Associates, 2005

belt loop southbound to MT Hwy 3 eastbound turning movement. A possible downside to this alternative is the installation of a traffic signal on MT Highway 3, thus introducing a delay component to the highway. Furthermore, MDT would prefer to not install a traffic signal on MT Highway 3 in an effort to maintain a free-flowing movement along the highway. A conceptual rendering of this alternative based on a 3-lane typical road section is depicted in Figure 19.

- **Conceptual Intersection Alternative 2** - A modified QRI incorporating a modern urban roundabout intersection north of the underpass of MT Hwy 3 by Zimmerman Trail and a modern roundabout intersection west of Zimmerman Trail. With much of the same benefit as Alternative 1, Alternative 2 would incorporate a second roundabout west of Zimmerman Trail along MT Hwy 3. A roundabout located east of Zimmerman Trail may not be feasible due to the location of a private road and residential structures located south of MT Hwy 3. The benefit of this alternative would be to further reduce delay for southbound inner belt loop to eastbound MT Hwy 3 traffic as well as minimizing delay to MT Highway 3 traffic, although there may be issues related to Section 4(f) lands (Zimmerman Park) located west of Zimmerman Trail. A conceptual rendering of this alternative based on a 3-lane typical road section is depicted in Figure 20.

- **Conceptual Intersection Alternative 3** - Underpass MT Highway 3 by Zimmerman Trail and construct a "tight urban diamond interchange" or TUDI with ramps from MT Highway 3 to Zimmerman Trail. This option would not introduce any intersection delay to MT Highway 3, but may have issues related to nearby residential structures as well as Section 4(f) lands (Zimmerman Park) located west of Zimmerman Trail.

Modern Urban Roundabouts

When built at appropriate sites and according to approved modern roundabout design guidelines, the modern urban roundabout is generally considered one of the safer types of intersection control due to the reduction of both the number of conflict points between vehicles and the severity of accidents within the intersection. Within roundabouts, right angle crashes are typically less severe and less frequent, and left turning crashes do not occur due to the removal of left turns. Moreover, rear-end type crashes become less frequent because roundabouts typically have less queuing than signalized intersections.[14]

[14] http://www.roundaboutsusa.com/design.html

It is important to note that in 2005 the Montana Legislature passed a resolution (House Joint Resolution No. 12) encouraging the Montana Department of Transportation and Montana cities and towns to consider roundabout installations instead of right angle intersections citing the following supporting data[15]:

- the Insurance Institute for Highway Safety reports that nationwide, fatal crashes at intersections increased 18% during the period between 1992 and 1998

- the absence of right angles, combined with the necessary reduction in speed, makes roundabouts safer for pedestrians and bicyclists as well as for motorists

- an 8-state study of 24 intersections before and after construction of roundabouts found a 39% decrease in crashes and a 76% decrease in crashes that resulted in injury

- constructing properly designed roundabouts instead of right-angle intersections in Montana would likely reduce the number of crashes and the number of injuries suffered by Montana motorists

[15] A copy of House Joint Resolution No. 12 can be viewed online at http://data.opi.state.mt.us/bills/2005/billhtml/HJ0012.htm

Figure 19. QRI Alternative 1

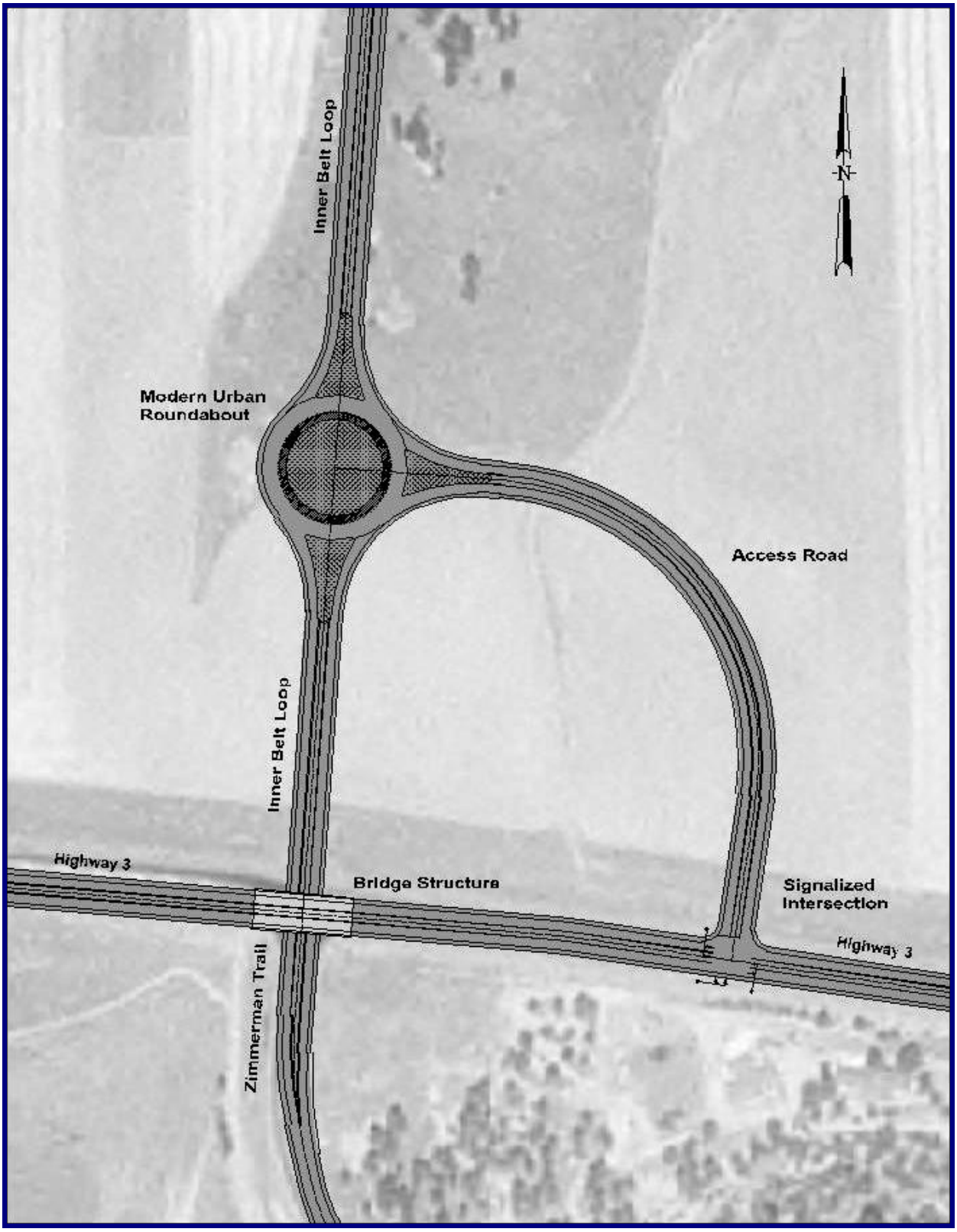
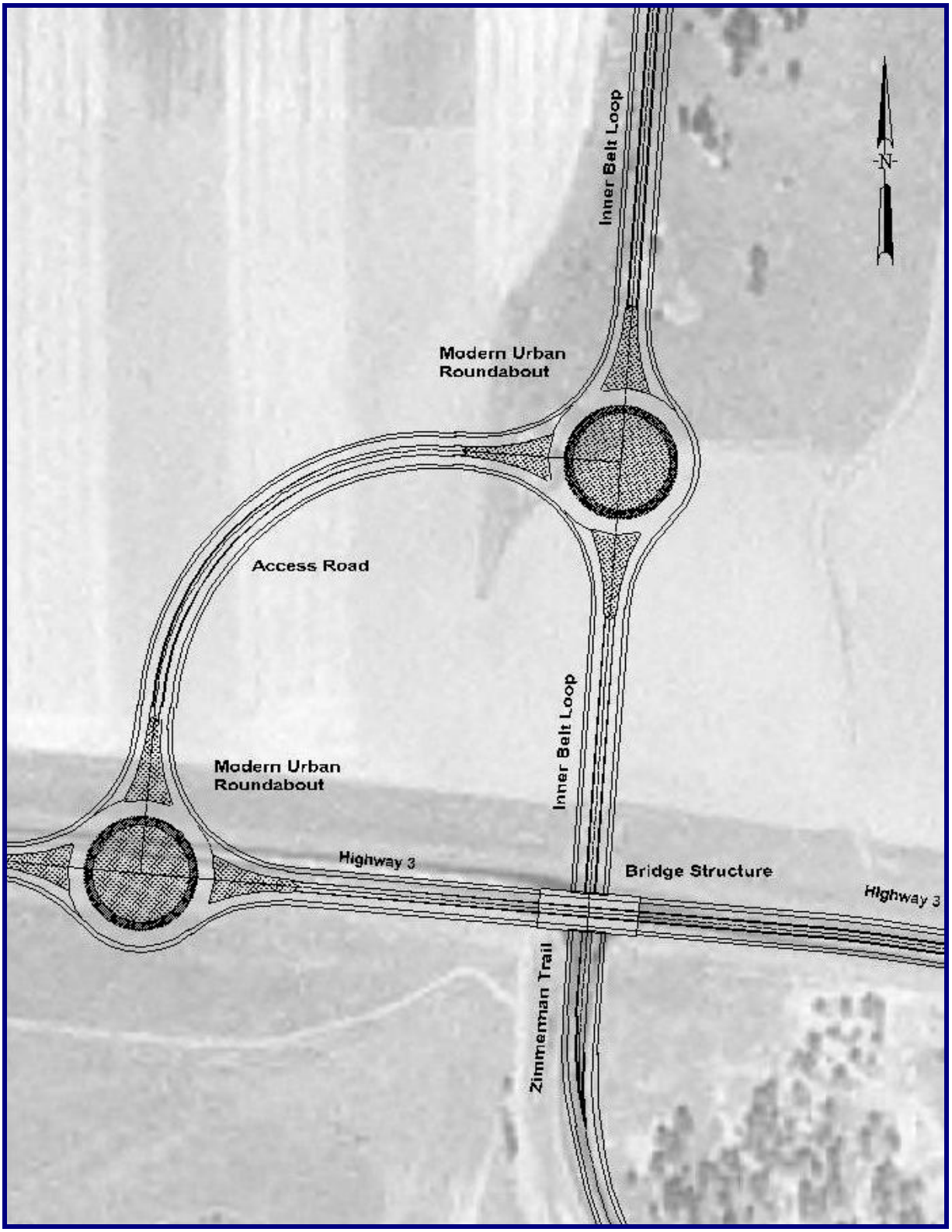


Figure 20. QRI Alternative 2



E. Economic Evaluation

The determination of the economic feasibility of an engineering project usually revolves around the comparison of the projects expected economic benefits to the projects economic costs, or the ratio of benefit to cost (B-C ratio). A specific B-C ratio was not analyzed for this planning study, as this level of economic analysis was not considered necessary by the Billings City-County Planning Department for this project at this time. The continued development of an inner belt loop concept, including corridor preservation, is considered necessary and worthwhile for the Billings community regardless of a benefit-cost comparison. As such, potential project costs are the only economic factors being considered for this planning study.

Economic Study Parameters

Assuming a project is feasible in terms of constructability, the economic parameters used in determining the potential costs associated with a planning-level corridor form the core of the overall planning study, as these parameters tend to lend the greatest influence towards future decisions regarding continued corridor development. The parameters used in this analysis are listed below.

- **Corridor Geometrics** - Five (5) final corridor alternatives were evaluated as both a 2-lane rural highway and a 4-lane urban arterial based on approved City of Billings and Yellowstone County subdivision regulations, and MDT highway standards. Phased development of the various routes was not considered during this evaluation, assuming the entire corridor would be developed under a single contract. It should be noted, however, that the development of some segments of the road could be realized through phased construction, including sections constructed through developer contributions.

- **Analysis Period** - No analysis period was assumed for this planning study. All costs are assumed in present dollars. Once a corridor is selected, a more detailed opinion of probable development costs can be determined during the next phase of project development, which should including economic costs based on an anticipated construction year. For future planning purposes, costs reported in this study should be appropriately inflated to account for assumed future material costs.

- **Construction Costs** - Average MDT and City of Billings bid prices for similar project elements were used to estimate possible construction costs for the various planning corridors. Due to the planning level nature of this study, various aspects of the possible

construction costs were assumed based on similar construction projects. Costs include materials, mobilization, preliminary and construction engineering, and contingencies.

- **Right-of-Way** - Current local market values of land within, adjacent to, or near the project study area were used to estimate right-of-way costs. The extent of right-of-way that may be required was estimated based on standard City and County right-of-way requirements, preliminary horizontal and vertical layouts, typical roadway sections, and assumed excavation/embankment limits corresponding to a level of development consistent with a planning level evaluation. Right-of-way estimates do not account for the development of new subdivisions or the annexation of parcels into the Billings city limits, both of which should be expected within the study area.

- **Potential Funding Sources** - Project funding and funding sources are not specifically considered in this study. However, the identification of potential funding and funding sources are vital towards the continued development of any engineering project. Although not an all-inclusive listing, possible funding sources include Surface Transportation Program Hazard Elimination Funds (STPHS), State Fuel Tax Funds (City and County), MDT Urban Funds, and the newly adopted City of Billings arterial fund. Additional funding could be realized through the Surface Transportation Program Urban Funds (STPU) and special Federal appropriations. Moreover, project costs could be shared through developer contributions and construction as defined within the formal subdivision processes of the City of Billings and Yellowstone County, offsetting some local government contributions.

Determination of Potential Project Costs

Planning level project development costs have been estimated for each of the alternative corridors. The following sections define the basic costs used to estimate the planning level opinions of cost, including project planning, pre-construction, right of way, and construction. As this study is a review of engineering feasibility, and not overall feasibility, maintenance and operational costs were not included in the development of the corridor cost analyses, although costs related to these activates should be expected. The cost evaluations are based on recent MDT and City of Billings bid tabulations, and include the following items:

- **Design Engineering** - Estimated at 8% of the total Construction Cost

- **Construction** - Based on current material costs (bid tabulations) for similar road development work. Elements of construction include excavation, site preparation, paving

materials, drainage, structures, and intersection improvements. Items not specifically identified are accounted for under "Miscellaneous Items" and "Contingency".

- **Contingency** - A 20% contingency factor was applied to all planning level opinions of cost for each of the final corridor alternates to account for development unknowns related to the planning nature of this level of study.

- **Contractor Mobilization** - Contractor costs related to the mobilization and moving of personnel, facilities, and equipment, and the procurement of materials prior to the commencement of construction activities. For the planning purposes, mobilization is estimated at 10% of the construction costs.

- **Construction Engineering** - Costs associated with testing, survey, and inspection during construction projects. Estimated at 10% of the construction costs.

- **Right of Way Acquisition** - Based on estimated acreage necessary to meet minimum City of Billings and Yellowstone County principal arterial standards and current costs of the varying land types and zones within the project study area.

- **Construction Permits** - For the purpose of this study, construction permits are estimated on a per mile basis. Construction permits are acquired through the right-of-way negotiation process to temporarily enter onto and/or use private property for the purpose of facilitating construction of the roadway. A construction permit does not transfer any permanent interest in the property.

- **Utility Relocations** - Although often necessary and usually costly, costs associated with utility relocations are not included in the final opinion or probable costs as the determination of this cost is generally unique to each project corridor. Regardless, some level of cost should be assumed as necessary during project development.

Opinion of Probable Project Costs

Based on the geometric design criteria and cost elements described and discussed above, opinions of probable project costs were developed and are summarized in Tables 4 and 5. Estimate worksheets are included in **Appendix II** of this document.

Table 4. Opinion of Costs: Rural 2-Lane (Current Dollars)

Cost Elements	Corridor 1A	Corridor 1B	Corridor 2A	Corridor 2B	Corridor 3
Corridor Length	31,300 ft	31,132 ft	35,500 ft	34,340 ft	37,550 ft
	5.928 mi	5.896 mi	6.723 mi	6.504 mi	7.1212 mi
Cost Elements					
Construction Costs	$13.24M	$13.12M	$14.34M	$13.87M	$15.28M
Right-of-Way	$871K	$917K	$880	$914K	$1115K
Total of Estimated Costs	**$14.11M**	**$14.04M**	**$15.22M**	**$14.78M**	**$16.40M**
Cost per Mile	**$2.38M**	**$2.38M**	**$2.26M**	**$2.27M**	**$2.31M**

Table 5. Opinion of Costs: Urban 4-Lane (Current Dollars)

Cost Elements	Corridor 1A	Corridor 1B	Corridor 2A	Corridor 2B	Corridor 3
Corridor Length	31,300 ft	31,132 ft	35,500 ft	34,340 ft	37,550 ft
	5.928 mi	5.896 mi	6.723 mi	6.504 mi	7.1212 mi
Cost Elements					
Construction Costs	$22.29M	$22.40M	$24.38M	$23.23M	$25.90M
Right-of-Way	$871K	$917K	$880	$914K	$1115K
Total of Estimated Costs	**$23.16M**	**$23.32M**	**$25.26M**	**$24.14M**	**$27.01M**
Cost per Mile	**$3.91M**	**$3.95M**	**$3.76M**	**$3.71M**	**$3.80M**

F. Public Involvement

Public comment is an important aspect of developing a thorough and meaningful planning study. As such, the public was provided information about the planning study throughout the study process via newspaper articles as well as through various project presentations. Public comments and opinions were considered towards the development of the final corridor alternatives and the study recommendations.

The following list discusses the public involvement activities and comment opportunities to date. Reproductions of various newspaper articles related to this project are provided in the appendices of this report. Detailed meeting descriptions are provided herein.

- November 12, 2004 — Billings Gazette, Article
- January through July, 2005 — Landowner Coordination Discussions, Ongoing
- January 14, 2005 — Billings Gazette, Article
- April 7, 2005 — Cultural Study, Landowner Permission Letters
- June 26, 2005 — Billings Gazette, Article
- June 27, 2005 — Billings Gazette, Public Meeting Notice
- Unknown — City of Billings Web Site, Public Meeting Notice (http://ci.billings.mt.us/Government/planning/index.php)
- June 28, 2005 — Heights Task Force Regular Meeting
  Tuesday, June 28, 7:00 PM
  Castlerock Junior High School
  Attendance: +/- 15
- June 29, 2005 — Public Informational Meeting
  Wednesday, June 29, 7:00 PM
  Castlerock Junior High School
  Attendance: +/- 30

- July 7, 2005 Billings Gazette, Article

Heights Task Force Regular Meeting

A presentation of the Inner Belt Loop Connection Planning Study was presented to the Heights Task Force by HKM Engineering Inc. as part of their regular meeting agenda on Tuesday, June 28, 2005. The meeting was attended by +/-15 individuals, representing the Heights Task Force members and local officials, including a member of the Billings City Council. Public comment forms were handed out prior to the start of the meeting, and a PowerPoint presentation discussing the various aspects of the project, including geometrics, landowner considerations, economics, traffic, and cultural/archeological concerns, was performed by HKM. A copy of the Height Task Force meeting agenda is included in **Appendix III** of this report.

At the meeting, it was noted by Heights Task Force members that the concept of an inner belt loop is considered vital by residents of the Billings Heights area as evident by a survey performed by the Heights Task Force indicating that 60% of those surveyed believe the development of an inner belt loop should be a high priority for the City of Billings. This survey ranked the development of an inner belt loop third out of six potential projects listed for consideration, behind the Bench Blvd. extension and the Billings By-pass project (segment from Main Street to Interstate 90 at or near Johnson Lane).[16]

Of the final corridor alternatives, **Corridor 1B** was considered the most attractive of the 5 corridors by those present, with **Corridor 3** noted as the least attractive alternative. The remaining corridors received less discussion.

Public Informational Meeting

A public informational meeting was conducted for this planning study by HKM Engineering Inc. and the Billings City-County Planning Department on Wednesday, June 29, 2005. The meeting was attended by +/-30 individuals, representing the general public, local and state agencies, and the project team. Public Comment Forms were handed out prior to the start of the meeting, and a PowerPoint presentation discussing the various aspects of the project, including geometrics, landowner considerations, economics, traffic, and cultural/archeological concerns, was performed by HKM. Also presented for consideration where visualization renderings depicting how an inner belt loop concept could appear within the existing landscape, which are

[16] *Billings Heights – Resident/Business Survey*, Heights Task Force

presented in Figures 20 through 21. A copy of the public comment form is included in **Appendix III** of this study report.

The meeting served to present and discuss the purpose and scope of the inner belt loop planning study, as well as to present the information and data collected to date. Both the preliminary corridor segments and the final corridor alternatives were presented for consideration. Of the final corridor alternatives, **Corridor 1B** was considered the most attractive of the 5 corridors by those present and from returned comment forms, with **Corridor 3** as generally the least attractive of the alternatives typically due to its length and overall cost. Corridors that connected Wicks Lane to the inner belt loop generally received a more favorable review than those corridors that connected only to Alkali Creek Road.

Public Comment

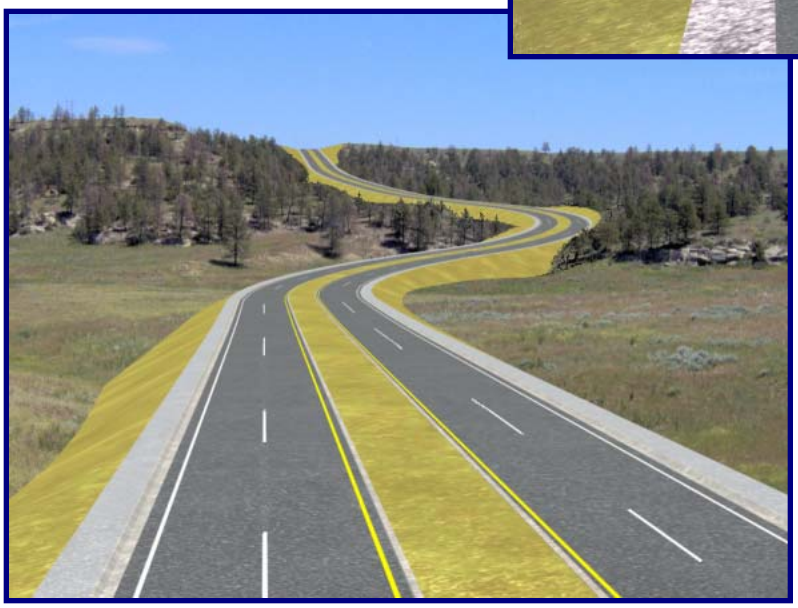
A public comment period, following the public informational meeting, extended 3 weeks from the meeting date. During that period, the public was asked to comment on the project as well as the information received from the informational meeting, through discussions with the project team, or from the various Billings Gazette articles regarding the project. During this period, only 3 comments were received (2 public meeting comment forms and 1 email). Of those comments, all were generally in favor of the continued development of an inner belt loop concept.

Figure 21. Inner Belt Loop Visualizations

Corridor 1A & 1B - Section 15 Midpoint Looking East

Existing

2-Lane Roadway

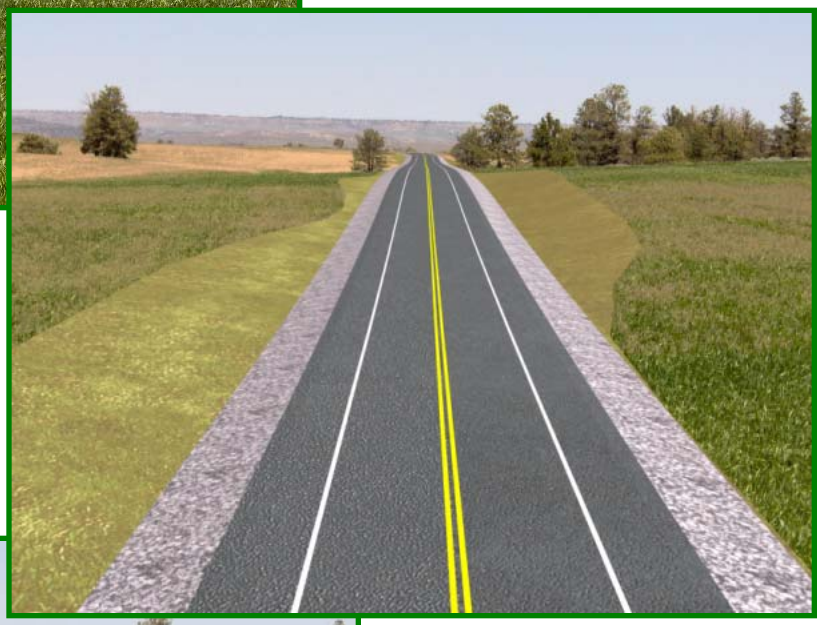


4-Lane Roadway

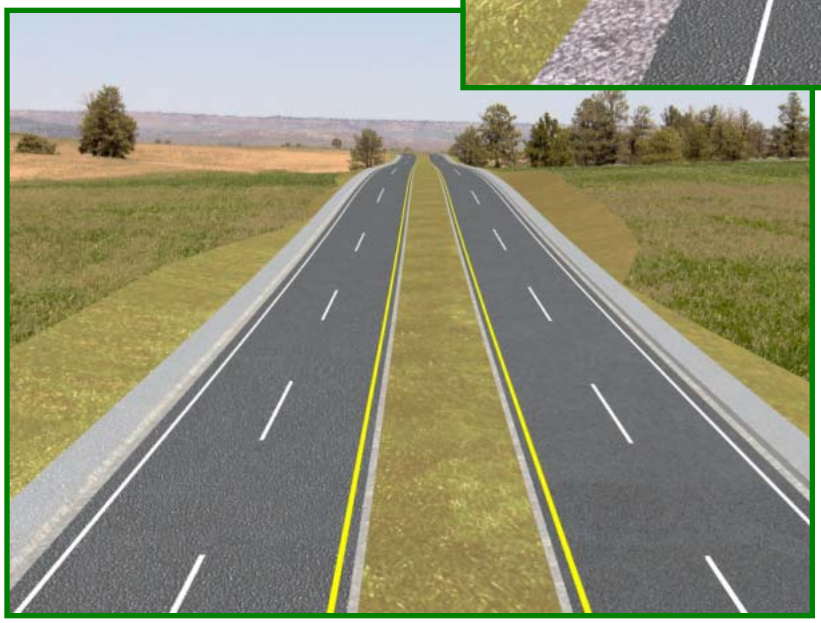
Figure 22. Inner Belt Loop Visualizations

All Corridors - North of Zimmerman Trail

Existing



2-Lane Roadway



4-Lane Roadway

VII. Study Conclusions and Recommendations

A. Study Conclusions

The purpose for conducting this planning study of the inner belt loop connection concept was to evaluate the engineering feasibility of developing a transportation corridor between the Billings Heights and MT Hwy 3 at or near Zimmerman Trail. To that end, several corridor alternatives were created for the purpose of determining the most advantageous corridor for continued study. The criteria utilized to perform this evaluation of the various corridor alternatives included constructability, probable cost, landowner and public opinion, a planning level environmental screening, and a planning level traffic analysis.

Initially, several preliminary corridor segments were developed for consideration within the projects study area. Meetings with area landowner reduced the number of preliminary segments to 5 basic corridors.

Each of the 5 remaining corridors was studied based on constructability, cultural and archeological instances, potential traffic loading, potential development costs, and pubic and agency perception.

Within these corridors, planning level alignments were developed and reviewed for constructability based on an analysis of a TIN topographical surface model created from USGS topographical quad maps of the area. Each alignment was evaluated horizontally (plan) and vertically (profile) to ensure that reasonable horizontal curves, vertical curves, and grades could be attained. Of the remaining final corridors, all are considered constructible based on this analysis.

A cultural and archeological review of historical data provided by MT SHPO of the remaining corridors identified several instances of concern within the study area. Of these instances, none were located in direct conflict with the remaining corridors. A ground survey performed during the study process also did not identify any new instances of concern within the remaining corridors. However, through discussion with landowners, local experts, and MT SHPO, an unregistered site was identified within **Corridor 2A**, **Corridor 2B**, and **Corridor 3**. Although currently not a protected site, indications suggest that the site may be eligible for protection. Albeit the identification of this site within these corridors is technically not a fatal flaw due to the sites current classification, disruption of this site is not recommended due to potential costs to study and mitigate the site.

Each of the corridors will attract traffic to varying degrees. Of the five corridors, **Corridor 1B** appears to exhibits the highest level of attraction in comparison with the other corridors while offering traffic reduction opportunities to Airport Road and to Main Street by offering alternative routes between the Billings Heights and the west and southwest of Billings.

A review of the potential development costs that could be associated with each corridor indicates that a 2-lane rural section could be developed at an average cost of $2.3 to $2.4 million per mile, and total costs of $14.0 to $16.4 million. Consideration of a 4-lane urban section suggests development costs at an average cost of $3.7 to $4.0 million per mile, and total cost of $23.1 to $27.0 million. Of all the corridors, **Corridor 1A** and **Corridor 1B** demonstrate the lowest development costs.

The acceptance of this planning study from a social perspective is evidenced by the generally positive comments received from both landowners within the study area and the general public. With respect to public comment, the most desirable corridor alternative was identified as **Corridor 1B** due to the corridors direct routing between the Rehberg Ranch subdivision and Wicks Lane, and the corridors apparent ability to attract traffic. **Corridor 3** was considered the least desirable alternative due to the corridors length and indirect routing through the study area.

In conclusion, the analysis offered within this planning document has demonstrated that:

- The proposed inner belt loop connection is consistent with community goals and approved planning documents
- The proposed inner belt loop connection is feasible from a planning level engineering standpoint for each of the final corridor alternatives
- Although specific instances of cultural or archeological concern do exist within the study area, viable corridor routes through the study area are possible
- The continued development of an inner belt loop connection is acceptable from a landowner and public perspective

B. Recommendations

Due to the results of this planning study, continued development of an inner belt loop connection is considered feasible. Based on the engineering analysis, cultural and archeological analysis, and landowner and public comment, the corridor alternative recommended for further study and development is **Corridor 1B**.

APPENDIX I
TRAFFIC

APPENDIX II
COST ANALYSIS

APPENDIX III
PUBLIC COMMENT